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DEDICATION

The Journal **AMPHIPACIFICA** is dedicated to the promotion of systematic biology and to the conservation of Earth's natural resources.

This issue is dedicated to the memory of Norma Eleanor Jarrett, 1931 - 2001.

Cover design: Adapted from the title page of S. J. Holmes (1904). "Amphipod Crustaceans of the Expedition."

Norma Eleanor Jarrett, 1931-2001: A Tribute

With the death of Norma Eleanor Jarrett, on April 25, 2001, the scientific community lost a major contributor to aquatic systematic research in Canada. Norma began her scientific career relatively late in life. Following her marriage to John W. Jarrett in 1952 in Ottawa, and the raising of three children to adulthood, in 1975 she answered a call for volunteer research assistance at the National Museum of Natural Sciences. She first worked with staff scientist Dr. Rita O'Clair on collections of marine polychaete worms and, during the following summer, Norma experienced her first marine field work on the Pacific coast of Canada. Following Dr. O'Clair's departure for the marine laboratory at Auke Bay, Alaska, Norma began systematic work on selected groups of marine amphipod crustaceans of the North American Pacific coast. With museum staff scientist, Dr. E. L. Bousfield, she first published an extensive list of NMNS west coast field stations, followed by a revision of the lysianassid amphipod genus *Hippomedon*. In the meantime, at nearby Carleton University, she attended day courses in biology essential to a BSc degree, but not completed. Norma continued identification of Pacific amphipod collections, first at the museum's "Beamish building" laboratory on Carling Avenue and later at more commodious research quarters in the Holly Lane building in southeast Ottawa.

During the late 1980's, the museum's research publication series "Syllogeus" and "Bulletin" were terminated. These had offered important outlets for large copiously illustrated papers on the systematics of extensive Canadian Pacific aquatic invertebrate faunas that traditional journals found difficult or impossible to accommodate. To fill this hiatus, creation of the privately funded research journal *Amphipacifica* in the early 1990's enabled Norma to continue meeting the



challenge of publishing upon these taxonomically difficult, biologically diverse, but mainly unknown "middlemen" of marine food energy cycles. She published, with help from line illustrator Susan Laurie-Bourque and in co-authorship with other scientists, 6 major lists and research papers. These treated more than 120 amphipod species, and included one new subfamily, 7 new genera, and 37 new species. Her final research paper, with Dr. Traudl Krapp-Schickel, Bonn, Germany, was published a few months before her death, and an additional three papers await publication.

This lovely, warm, and capable person was cherished by her husband, her family, and her grandchildren, and will be greatly missed by her many friends and museum colleagues.

The Editors

Research Publications of Norma E. Jarrett

1. Bousfield, E. L., & N. E. Jarrett 1981. Station lists of marine biological expeditions of the National Museum of Natural Sciences in the North American Pacific coastal region, 1966-1980. *Syllogeus* No. 34: 66 pp., 13 figs.
2. Jarrett, N. E., & E. L. Bousfield 1982. Studies on amphipod crustaceans of the northeastern Pacific region. I. 4. Family Lysianassidae, genus *Hippomedon*. *Nat'l. Mus. Nat. Sci., Publ. Biol. Oceanogr.* 10: 103-128, 9 figs.
3. Jarrett, N. E., & E. L. Bousfield 1994. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part I. Metharpiiniinae, new subfamily. *Amphipacifica* 1 (1): 58-140, 31 figs.
4. Jarrett, N. E., & E. L. Bousfield 1994. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part II. Subfamilies Pontharpiiniinae, Parharpiiniinae, Brolginae, Phoxocephalinae and Harpiiniinae. Systematics and distributional ecology. *Amphipacifica* 1 (2): 71-150, 36 figs.
5. Jarrett, N. E., & E. L. Bousfield 1996. The amphipod superfamily Hadzioidea on the Pacific coast of North America. Part I. The *Melita* group: systematics and distributional ecology. *Amphipacifica* 2(2): 3-74, 41 figs.
6. Krapp-Schickel, T., & N. E. Jarrett 2000. The amphipod family Melitidae on the Pacific coast of North America. Part II. The *Maera-Ceradocus* complex. *Amphipacifica* 2 (4): 23-61, 14 figs.

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G. J. Torres, A. Lombarte & B. Morales-Nin

The size range of suspended particles trapped and ingested by the filter-feeding lancelet *Branchiostoma floridae* (Cephalochordata: Acrania),

E. E. Ruppert, T. R. Nash & A. J. Smith



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THE AMPHIPOD SUPERFAMILY LEUCOTHOIDEA ON THE PACIFIC COAST OF NORTH AMERICA: FAMILY AMPHILOCHIDAE: SYSTEMATICS AND DISTRIBUTIONAL ECOLOGY.

P. M. Hoover¹, and E. L. Bousfield²

ABSTRACT

Previous definitions of component genera and their probable relationships within the gammaridean amphipod family Amphilochidae were found to be unsatisfactory, necessitating realignment of taxonomic groupings within the northern hemisphere. *Apolochus* n. g., encompassing the Mediterranean regional type species *A. neopolitanus* (Della Valle, 1893), and *A. litoralis* (Stout, 1912), *A. barnardi*, n. sp., and *A. staudei*, n. sp. from the North Pacific region, is separated from *Amphilochus* Bate, 1862, based on the North Atlantic type species *A. manudens* Bate, 1862. *Hourstonius*, n. g., based on the North Pacific type species *H. vilordes* (J. L. Barnard, 1962), is segregated from the Arctic and North Atlantic genus *Gitanopsis* Sars, 1895, based on *G. bispinosa* Boeck, 1871. Also redefined is *Gitana* Boeck, 1871, based on the Arctic type species *G. sarsi* Boeck, 1871, and including *Gitana ellisi*, n. sp., from the northeastern Pacific region.

Numerical analysis of 20 generic-level characters and character states suggests that *Hourstonius* and *Apolochus* are closely related, boreal and warm-temperate, North Pacific and North Atlantic generic complexes. By contrast, the primitive Arctic and North Atlantic genera *Gitana* Boeck, *Gitanopsis* Sars (*sens. str.*) and *Amphilochus* Bate (*sens. str.*) are closely related and possibly antecedent to the more advanced Mediterranean and "Pangean" genera *Amphilochoides* Sars, *Paramphilochoides* Lincoln, and *Amphilochella* Ledoyer. The diversity of eastern North Pacific species of Amphilochidae is below that of equivalent latitudes of the western North Pacific and eastern North Atlantic regions, but reasons for these differences are speculative.

INTRODUCTION

Amphilochids are small, colourful, benthic leucothoidean amphipods commensal with sea fans, hydroids and other sessile marine invertebrates. During the past century and half of faunistic explorations of the Pacific coast of North America, only three species had previously been recorded, none prior to the turn of the century (Stimpson 1857; Stebbing 1906).

The first regional species was described from southern California by Vimy Stout in 1912. Three additional new species were described from California by J. L. Barnard (1962, 1969b). He also listed species from deeper waters and submarine canyons (1966), and described the ecological occurrence of species in the rocky intertidal of south-central California (1969b; 1975).

Among semi-popular accounts, Ricketts & Calvin (1968) included only "*Amphilochus neopolitanus*" among "common intertidal amphipod species" of the North American Pacific coast. Staude (1987) included four amphilochid species in lists and keys from the northwestern Pacific region, and Austin (1985) listed the same species from this general region, but none actually from the coast of British Columbia.

Gurjanova (1951) had listed amphilochids from the

North Atlantic, Black Sea, and Arctic (Barents Sea) regions, and Shoemaker (1955) recorded *Gitanopsis arctica* from Pt. Barrow, Alaska. Barnard (1970) described several new taxa from the Hawaiian archipelago. However, few amphilochid species had been recorded elsewhere in the North Pacific until the extensive work on Japanese coastal marine species by Hirayama (1983). These, and more recent records from Japan, were summarized in phyletic classification by Ishimaru (1994).

The present study encompasses the previously untreated amphilochid fauna of the Canadian Pacific and adjacent coastal marine regions and places it in the context of systematic concepts developed elsewhere.

ACKNOWLEDGEMENTS

Completion of field work, 1955-1980, was greatly assisted by several marine research agencies and their staffs, and were acknowledged in published stations lists (Bousfield 1958, 1963, 1968; Bousfield & McAllister 1962; Bousfield & Jarrett 1981). The authors are indebted to the Pacific Biological Station, Nanaimo, the Bamfield Marine Station, and the Friday Harbor Laboratories, WA, with special thanks to bi-

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ologist Dr. Craig P. Staude. Dr. D. V. Ellis kindly provided laboratory facilities at the University of Victoria for much of the identification work. Dr. Pierre Brunel, Université de Montréal, provided illustrations and helpful commentary on a proposed new amphilo- chid taxon from the St. Lawrence estuary.

The authors are grateful for facilities at the Holly Lane laboratory provided by the Canadian Museum of Nature, Ottawa, during 1992-1995, and to the collec- tions management staff of the CMN, especially Judith Price, for more recent help in cataloguing and label- ing type material. The original line illustrations were prepared with the capable assistance of artist Floy E. Zittin, Cupertino, CA.

SYSTEMATICS

AMPHILOCHIDAE Boeck

Amphilochidae Boeck, 1871: 107;—Stebbing 1906: 149;—Barnard 1962: 116;—Barnard 1969a: 132;— Lincoln 1979: 146;—Krapp-Schickel 1982: 70;—Bous- field 1982: 266.—Barnard & Karaman 1991: 92.

Type Genus: *Amphilochus* Bate, 1862 (N. Atlantic).

Genera:

North Pacific: *Gitana* Boeck, 1871; *Hourstonius*, n. g. (p. 11); *Apolochus* n. g. (p. 15); *Paramphilochus* Ishimaru & Ikehara, 1986; *Afrogitanopsis* Karaman,

1980 (Indian Ocean-Japan).

Extralimital: *Gitanopsis* Sars, 1895 (Arctic-N. Atlan- tic); *Amphilochoides* Sars, 1895 (N. Atlantic-Mediter- ranean); *Gitanogeiton* Stebbing, 1910 (Southwestern Pacific); *Amphilochopsis* Stephensen, 1925 (Arctic); *Amphilochella* Schellenberg, 1926 (Antarctic-Indian); *Rostrogitanopsis* Karaman, 1980 (S. African); *Cyclotelson* Potts, 1915 (Indo-Pacific). An unde- scribed genus is listed from the St. Lawrence estuary by Brunel et al. (1998).

Diagnosis: Body small, smooth; abdominal segments separate, generally unornamented. Anterior head lobe acute or rounded; rostrum distinct; eyes rounded. An- tennae short; accessory flagellum minute or lacking. Flagellum of antenna 1 longer and more richly armed with aesthetascs in male.

Mouthparts modified: upper lip apically notched, lobes often asymmetrical; lower lip tall, inner margins often "notched", inner lobes essentially lacking. Man- dible: molar various, often much reduced; spine-row strong; palp slender. Maxilla 1, inner plate small, outer plate strongly spined and/or toothed, palp 1- or 2- segmented. Maxilla 2 small, weakly setose. Maxilli- ped inner plate slender; outer plate broad; palp me- dium, dactyl not falciform.

Coxae 2-4 deep, increasing posteriorly; coxa 1 small, partly hidden by coxa 2. Gnathopods usually subchel- ate, often dissimilar in form and size, not sexually dimorphic. Gnathopod 2 usually the larger; posterior

KEY TO NORTH PACIFIC GENERA OF AMPHILOCHIDAE (see also Fig. 1)

1. Peraeopods 3-7 prehensile; gnathopod 2 sexually dimorphic *Afrogitanopsis* (Japan)
Peraeopods 3-7 ordinary, ambulatory; gnathopod 2 similar in both sexes 2.
2. Telson elongate, sharply acute, apex minutely dentate; coxae 2-4, lower margin serrate; accessory flagellum lacking or very minute. 3.
Telson apex smoothly and sharply rounded, rarely acute; coxae 2-4, lower margin smooth; accessory flagellum small, 1-segmented 4.
3. Gnathopod 2 distinctly parachelate, propod large; maxilla 1, palp 2-segmented; mandibular molar not triturative *Paramphilochus* (Japan)
Gnathopods 1 & 2, propods small, nearly simple, palm weakly (or not) distinct from hind margin; max- illa 1, palp 1-segmented; mandibular molar normally large, triturative (Fig. 1B) *Gitana* (p. 6)
4. Mandibular molar large, triturative, with marginal fringe of slender spines (Fig. 1c); gnathopod 1, propod broadening distally, sub-triangular; peraeopod 5, brood lamella longer than basis, with 8 + marginal setae; peraeopods 3 & 4, dactyls medium, slender *Hourstonius* (p. 11)
Mandibular molar vestigial, triturating surface weak or lacking; gnathopod 1, propod slightly (or not) broadening distally, anterior margin convex; peraeopod 5, brood lamella small, with 5-6 marginal setae; peraeopods 3 & 4, dactyls short *Apolochus* (p. 15)

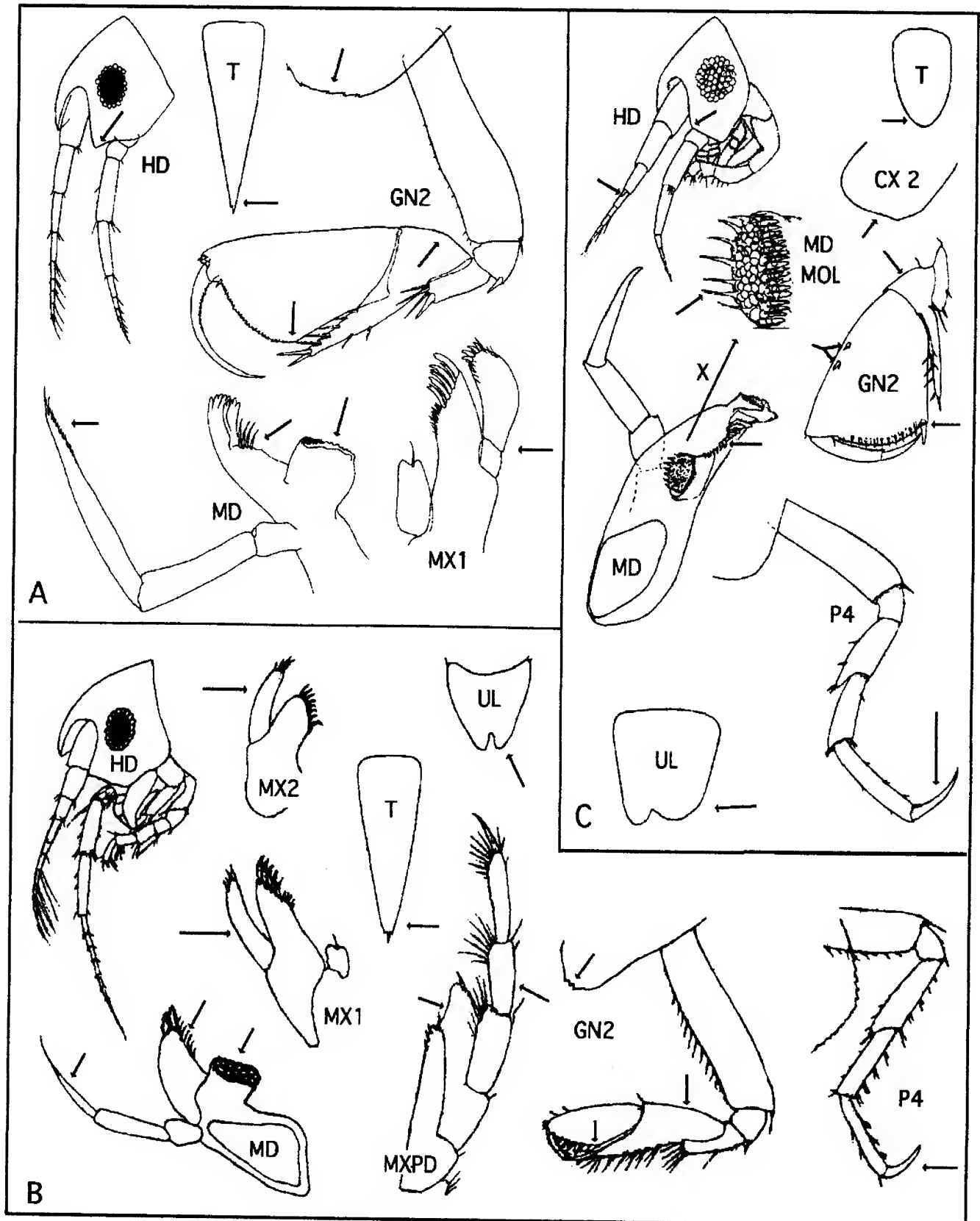


Fig. 1. Characters and Characters states of *Gitanopsis*, *Gitana*, and *Hourstonius*. A. *Gitanopsis inermis* (modified from Lincoln (1979). B. *Gitana sarsi* (modified from Sars (1895); C. *Hourstonius laguna* (after McKinney 1978). [see p. 28 for figures legend]

lobe of carpus typically extended forward behind propod. Coxae 5-7 deep, regularly postero-lobate. Peraeopods slender. Peraeopods 5-7 usually subsimilar in size and form; segment 4, posterodistal process not strongly overhanging segment 5.

Uropods slender, rami narrowly lanceolate. Uropod 2 small, rami unequal, rarely exceeding elongate peduncle of biramous uropod 3. Telson longer than wide, distally (sub)acute, minutely tridentate, or rounded, weakly (or not) keeled below.

Brood plates broad, decreasing posteriorly, margins long-setose. Coxal gills simple, on pereopods 2-6.

Remarks: Family Amphilochidae is a member of superfamily Leucothoidea, closely related to family Pleustidae (see Bousfield 1983; Bousfield & Shih 1994). Character states of coxal plates and uropods are also superficially similar to those of family Stenothoidae near which it often closely positioned (e.g., Stebbing 1906; Barnard 1962). Barnard & Karaman (1991) include family Amphilochidae within an amphilocoid group that encompasses families Cyproideidae, Pseudamphilochidae, and Bolttsiidae.

Family Amphilochidae presently encompasses 13 genera and about 70 species world-wide. A further yet undescribed genus, based on an undescribed *Gitanopsis*-like species, is listed tentatively from the St. Lawrence estuary by Brunel *et al.* (1998, p. 187). All but 5 essentially monotypic genera and about 85% of the species are endemic to the northern hemisphere. On this basis, and cognizant of the need for more realistic recognition of natural relationships, the partial realignment of North Pacific and North Atlantic species of *Amphilochus* Bate, *sens. lat.* and *Gitanopsis* Sars, *sens. lat.* would appear justified at this time [see Discussion and figs. 8-10].

Gitana Boeck

Gitana Boeck, 1871: 132;—Stebbing 1906: 155;—Chevreux & Fage 1925: 118;—Gurjanova 1951: 302;—Lincoln 1979: 162;—Krapp-Schickel 1982: 82, key;—Barnard & Karaman 1991: 96.

Type species. *Gitana sarsi* Boeck, 1871, designated by Sars 1895: 229.

Pacific Species: *Gitana abyssicola* Sars, 1895 (N. Atlantic); *G. calitemplado* Barnard, 1962 (California); *G. liliuokalaniae* Barnard, 1970 (Hawaii); *G. bilobata* Myers, 1985 (Fiji); *G. gracilis* Myers, 1985 (Fiji); *G. ellisi*, n. sp., (British Columbia).

Extralimital species: *G. sarsi* Boeck, 1871 (N. Atlantic); *G. rostrata* Boeck, 1871 (N. Atlantic); *G. longicarpa* Ledoyer, 1977 (Mediterranean); *G. dominica* Thomas & Barnard, 1990 (Caribbean).

Diagnosis: Anterior head lobe acute or rounded. Antennae unequal in length; accessory flagellum lacking or very minute.

Upper lip, lobes symmetrical. Lower lip, inner shoulders with sharp notch. Mandibular molar large, cushion-shaped, triturative; spine row moderate, 5-9 blades; palp segment 3 not elongate. Maxilla 1, palp 1-segmented. Maxilla 2, inner plate stout. Maxilliped, inner plate with two stout medially curved spines; inner margin of outer plate weakly excavate; palp segment 1 equal to segment 2.

Coxae 2 weakly serrate posterodistally. Gnathopods 1-2 small, weakly subchelate or simple; palm very oblique, dactyl often pectinate posteriorly. Peraeopods slender; dactyls relatively long.

Pleome side plate 2, hind corner squared or obtuse. Uropod 3, ram short, margins bare or nearly so. Telson long, tapering, apex acute, usually minutely tridentate.

Coxal gills small. Brood plates variable, usually large on pereopods 2 and 3.

Distribution: Pan arctic-boreal, N. Atlantic and N. Pacific, extending southwards into warm-temperate and tropical regions, in depths of 0-578 m.

Remarks: *Gitana* as presently defined, exhibits considerable morphological variation, especially in gnathopods, mouthparts and brood plates. Tropical species (e.g., *G. dominica*) show mouthpart character states similar to *Hourstonius* but a full revisionary analysis is outside the scope of the present study.

Gitana ellisi new species (Fig. 2)

Material examined.

British Columbia, Southern Vancouver Island:

ELB Stn. B21b, off Brady's Beach, Vancouver I. (48°0', 50'N, 125°0', 09'W), on sand, algae, 10-20 m, dredge, June 1, 1977.

- ♀ ov. **holotype**, slide mount; 2 ♀♀ **paratypes**; slide mount, NMCC1992-0242. Ibid. - 2 ♀♀ **paratypes**, NMCC1992-0243.

Victoria region, Saanich Peninsula (48°0'N, 123°0'W) (KEC Stn.?, no other data), 1981 - 2 ♀♀, NMCC1992-0252.

Diagnosis: Female ov (3.0 mm) holotype: Rostrum medium, apex slightly down curved. Eye large, black,

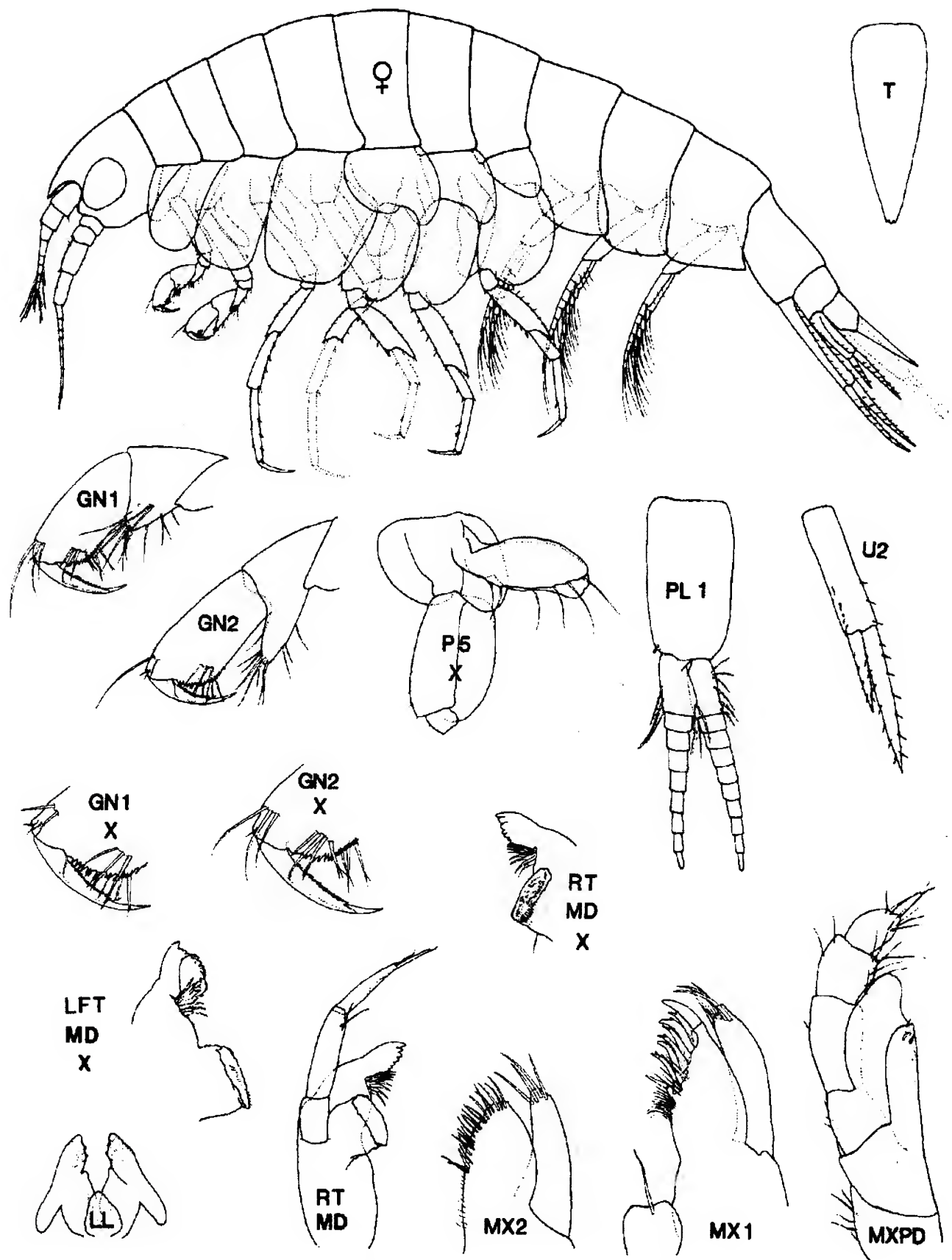


Fig. 2. *Gitana ellisi*, n. sp.. ♀ ov. (3.0 mm). Off Brady's Beach, Vancouver I., B. C.

Key to North Pacific and some North Atlantic species of *Gitana*.

1. Head lobe acute; coxa 2, lower margin sharply rounded, serrate medially; brood plates large . . . 2.
Head lobe rounded; coxa 2 smooth below or serration postero-distally; brood plates small 3.
2. Gnathopod 2, carpal lobe < 1/4 propod); peraeopod 7, basis widest medially *G. abyssicola* Sars
Gnathopod 2, carpal lobe, length >1/2 propod; peraeopod 7 basis widest distally . . *G. sarsi* Boeck
3. Gnathopods 1 & 2, propodal palm short, distinct, oblique *G. ellisi* n. sp. (p. 6)
Gnathopods 1 & 2, palm elongate, horizontal, continuous with posterior margin 4.
4. Gnathopods 1 & 2, propod distinctly longer than carpus, telson slender, elongate, length >2X basal width, apex acute, simple *G. calitemplado* Barnard
Gnathopod propod shorter than carpus; telson shorter, apex tidentate *G. liliuokilaniae* Barnard

almond-shaped, outer row of facets largest. Antenna 1 shorter than antenna 2, lacking accessory flagellum; peduncular segments short, flagellum 6-segmented. Antenna 2, flagellum 9-10 segmented.

Mandibular molar stout triturative; spine row with 7-8 slender blades; left lacinia ~8-dentate; palp segment 3 slender, shorter than segment 2, apex narrowly truncate, with 2-3 longish simple setae. Maxilla 1, outer plate oblique apex with 8 stout spine-teeth and proximal tuft of fine setae; palp stout, 1-segmented, with several apical setae. Maxilla 2, inner distal margin with several slender setae; outer plate stout, with 4 apical setae. Maxilliped, inner plate narrow, apex subtruncate; outer plate medium broad, with inner marginal sub-apical incision; palp segment 2 exceeding outer plate; segment 3 shorter than 2.

Coxa 1 narrow, rounded below; coxae medium deep, increasing posteriorly, smooth below. Gnathopods 1 & 2, propods small, subrectangular; palms short, oblique, convex, denticulate, not sharply demarcated at posterior angle; dactyls stout, pectinate behind, unguis overlapping palm. Gnathopod 1, carpal lobe very short, little produced. Gnathopod 2 larger, carpus shorter than propod, posterior lobe short, stiff-setose, extending about half length of propod.

Peraeopods 3 & 4 very slender, weakly armed; dactyls slender, medium long. Coxae 5-7 deeply posterolobate, margins unarmed. Peraeopods 5-7 regularly and subequally homopodous; bases regularly expanded, posteriorly slightly increasing in size; segment 4 long, 5 short; dactyls slender, medium long.

Pleon side plate 3, lower margin straight, hind corner slightly produced. Pleopod rami 9-10 segmented, slightly longer than thick peduncle. Uropod 1 slender, rami subequal, margins spinose. Uropod 2, rami marginally short-spinose; outer ramus >1/2 inner. Uropod 3, rami much shorter than slender peduncle,

marginally smooth, distinctly exceeding telson.

Telson narrowly subtriangular, apex tridentate

Brood plates 2-4 large; 5 small with 3-4 distal marginal setae.

Etymology: The species name recognizes the extensive contributions of Dr. Derek V. Ellis, University of Victoria, in the development and teaching of coastal marine ecological and environmental concepts.

Distribution: Only 7 specimens known; from shallow-sublittoral depths off southern Vancouver Island, B. C.

Remarks: *Gitana ellisi* is closest to *G. sarsi* Boeck; however, its larger eyes, more distinctly subchelate gnathopods with less produced carpal lobes, smaller coxal plates, and much less markedly reduced mandibular palp are more plesiomorphic character states than in *G. sarsi*.

***Gitanopsis* Sars (restricted)**

Gitanopsis Sars, 1895: 223;—Stebbing 1906: 153;—Gurjanova 1951: 302.

Gitanopsis Lincoln 1979: 164 (part);—Barnard 1962: 130 key (part);—Barnard & Karaman 1991: 97 (part). ~~non~~: *Gitanopsis* McKinney 1978: 140.—Karaman 1980: 44;—Hirayama 1983: 124.

Type species: *Amphilochus bispinosa* Boeck, 1871, original designation by G. O. Sars.

Species: *Gitanopsis inermis* Sars, 1883; *G. arctica* Sars, 1895;—Shoemaker 1955; *G. abyssicola* Sars, 1895; *Gitanopsis* sp. A, Just, 1980; *Gitanopsis* sp. B, Just, 1980.

KEY TO NORTH PACIFIC SPECIES OF *HOURSTONIUS**(Gitanopsis iseebi* Yamato transferred to *Afrogitanopsis*)

1. Gnathopods 1 & 2, propods subsimilar in size and shape, palmar angle squared, defined by small tooth and spine; carpus, posterior lobe short, little produced *H. pusilloides* (Shoemaker)
Gnathopod 2 distinctly larger than gnathopod 1, palmar angle obtuse, defined by spine(s) only; carpus of gnathopod 2 strongly produced posterodistally below propod 2.
2. Gnathopods 1 & 2, posterior angle of propod defined by single spine; maxilliped, outer plate markedly incised mediodistally; Hawaiian islands. *H. pele* (Barnard)
Gnathopod propods, posterior angle with paired spines; maxilliped, outer plate little or not incised mediodistally 3.
3. Telson apically acute, minutely bifid; maxilliped palp, segment 2 distinctly longer than segment 3; mandibular spine row short, ~6-bladed *H. japonica* (Hirayama)
Telson, apex subacute or rounded; maxilliped palp segment 3 short, not longer than segment 3; mandibular spine row with 8-12 blades 4.
4. Gnathopod 2, propod with two prominent anterior submarginal spines; gnathopod 1, anterior margin of basis setose throughout; maxilla 2, inner plate weak, little broader than outer 5.
Gnathopod 2 lacking anterior submarginal spines; gnathopod 1, anterior margin of basis nearly bare; maxilla 2, inner plate normal, setose, broader than outer plate 6.
5. Gnathopod 2, carpal lobe elongate, extending almost to palmar angle; telson elongate, length >2X maximum width; N. American Pacific *H. vilordes* (Barnard) (p. 11)
Gnathopod 2, carpal lobe short, ~ 3/4 length of posterior margin of propod; telson short, length 1.5 X maximum width; Gulf of Mexico *H. laguna* (McKinney)
6. Telson narrow, elongate, length > 2X maximum width; gnathopod 2, carpal lobe extending beyond posterior palmar angle 7.
Telson short, broader, length not > 2X width; gnathopod 2, carpal lobe not quite reaching posterior palmar angle *H. breviculus* (Hirayama).
7. Abdominal (epimeral) side plate 3, hind corner slightly produced; uropod 2, outer ramus normal, >1/2 length of inner ramus *H. robustodentes* (Hirayama)
Epimeral plate 3, hind corner squared or rounded; uropod 2 outer ramus short, not greater than 1/2 length of outer ramus *H. longus* (Hirayama)

Diagnosis: Rostrum medium; anterior head margin usually acute; eye round. Antennae usually subequal in length; accessory flagellum lacking or very minute.

Upper lip shallowly notched, lobes subsymmetrical. Lower lip, inner margins strongly notched. Mandible: molar process large, triturating surface without raised marginal spines; spine row with few blades; palp segment 3 elongate, setulose near apex. Maxilla 1 normal, palp 2-segmented. Maxilla 2 normal, inner plate narrow. Maxilliped palp slender, segment 2 often short.

Coxae 2-4 large, lower margin weakly serrate. Gnathopods 1 & 2 medium to weakly subchelate; prododal palm not demarcated from posterior margin; carpus of medium length, lobe produced. Peraeopods 3 & 4,

dactyls slender, medium. Coxae 5-7 regularly posterolobate. Peraeopods 5-7, dactyls slender, medium long.

Epimeral plate 3, hind corner subquadrate. Uropod 3 relatively short, little exceeding uropod 1. Telson elongate, narrowing, apex acute, minutely tridentate.

Distribution: Holarctic and northern North Atlantic, 0-875 m. in depth.

Remarks: *Gitanopsis sens. lat.* (e.g., Barnard & Karaman, *loc. cit.*) here consists of three groups: *Gitanopsis* Boeck *sens. str.* (Arctic and northern North Atlantic in distribution); and *Hourstonius* new genus, mainly in

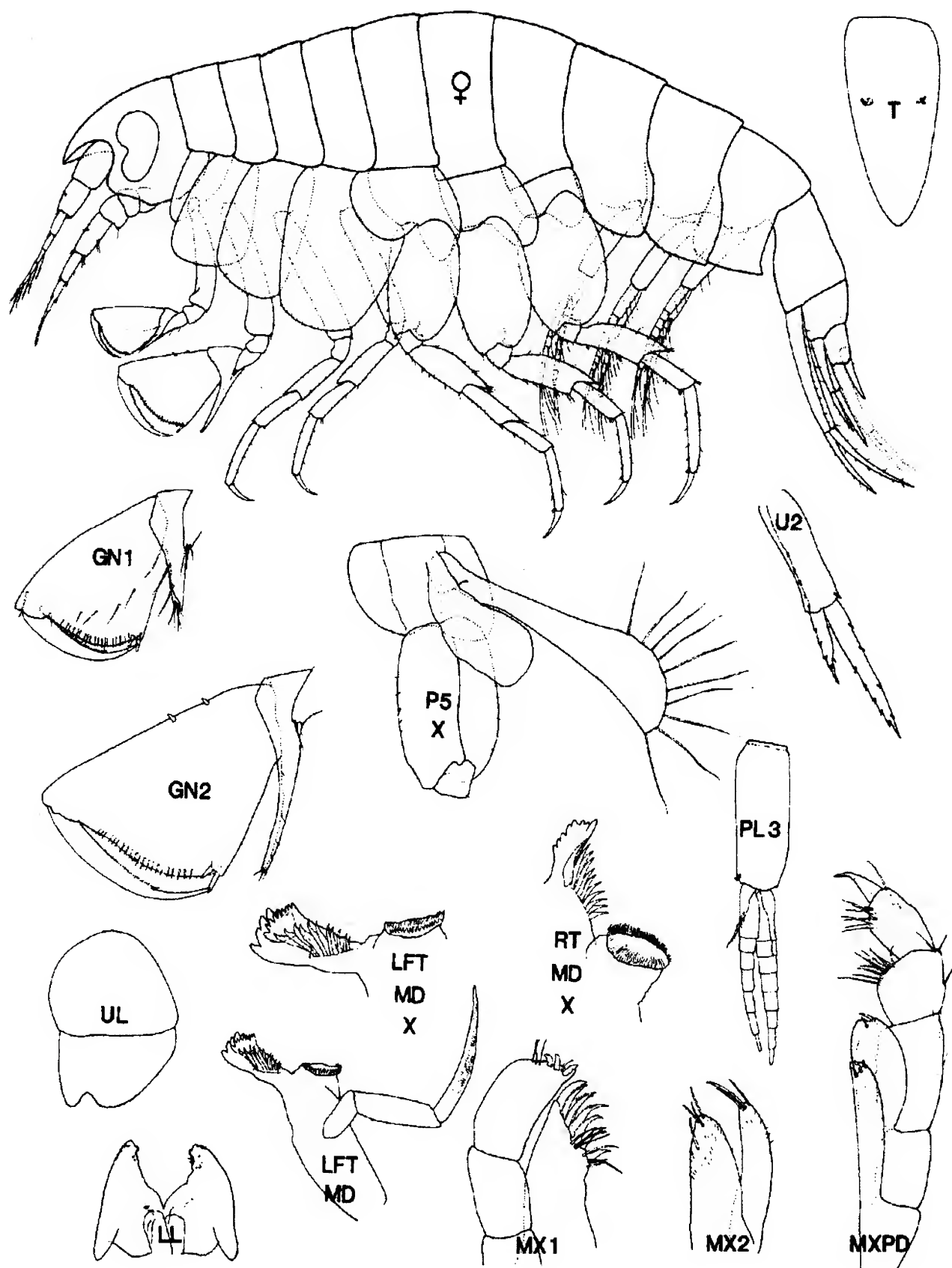


Fig. 3. *Hourstonius vilordes* (Barnard). ♀ ov. (3.9 mm). Hinks I., N. end Aristazabel I., B.C.

the North Pacific region, with some species in the Gulf of Mexico, and possibly coastal waters of the African South Atlantic region. A third generic group, informally recognizable and yet unnamed within *Gitanopsis* (*sens. lat.*), may be represented by *G. marionis* (Stebbing, 1888), as figured by Bellan-Santini & Ledoyer (1974), *G. tai* Myers, 1985, and several other largely Indo-Pacific and southern hemispheric species (except *G. squamosa* (Thompson, 1880) as listed by Barnard & Karaman (1991).

Principal characters and character states utilized in keys, diagnoses, and numerical analyses pertaining to the genus *Gitanopsis* (*sens. lat.*) are represented in Fig. 1 (p. 55).

Hourstonius, new genus

Gitanopsis Sars, 1895: 224 (part);— Barnard 1962: 130 (key, part);—Hirayama 1983: 124 (key);—Barnard & Karaman 1991: 97 (part);—Ishimaru, 1994: 52 (species list).

non *Gitanopsis* Gurjanova 1951: 302;—Lincoln 1979: 164.

Type species: *Gitanopsis vilordes* J. L. Barnard, 1962

Species: *Hourstonius breviculus* (Hirayama, 1983); *H. japonica* (Hirayama, 1983); *H. longus* (Hirayama, 1983); *H. robustodentes* (Hirayama, 1983) (Japan); *H. laguna* (McKinney, 1978); *H. tortugae* (Shoemaker 1942)(Florida); *H. pusilloides* (Shoemaker, 1933; *H. pusilla* (K. H. Barnard, 1916)(S. Africa); *H. pele* (J. L. Barnard, 1970); *H. baciroa* (J. L. Barnard, 1979) (Galapagos); *H. magdai* (Reid, 1951)(Trop. Atlantic) non: *Afrogitanopsis paguri* (Myers, 1974) (W. Indian); *A. iseebi* (Yamato, 1993)(Japan).

Diagnosis: Anterior head lobe generally rounded. Accessory flagellum 1-segmented or minute.

Upper lip notched, lobes asymmetrical; lower lip, inner marginal "notch" weak or lacking; mandible, molar distinct, outer triturating ridge with raised spines; maxilla 1, palp slightly modified; maxilliped, palp segment 3 short; coxa 2, lower margin smooth (not serrate); gnathopods 1 & 2 strongly subchelate, propod with paired spines at posterodistal angle demarcating palm; gnathopod 2, carpus narrow, posterior lobe elongate;

Epimeral plate 3, hind corner squared or rounded; telson linguiform, medium to long, apex broadly or sharply rounded (acute in *H. japonica*).

Distribution: Mainly North Pacific, with some species in the Gulf of Mexico, and possibly coastal waters of the African South Atlantic region.

Etymology: The genus is named in honour of the late Alan S. Hourston, fisheries scientist with the Pacific Biological Station, Nanaimo, British Columbia. Dr. Hourston, his wife Barbara, and their family provided much help and encouragement to the senior author and his family during the 25-year period of field work for the Pacific amphipod program, 1955-1980.

Remarks: Members of this genus are readily distinguished from species of *Gitanopsis* Sars (*sens. str.*) in possessing an accessory flagellum, more strongly subchelate gnathopods with shorter carpus; weakly (or not) serrated lower margin of coxa 2; and linguiform telson with rounded apex. Moreover, species of *Gitanopsis* (*sens. str.*) are mainly Arctic and North Atlantic in distribution.

Members of the third generic group (*G. marionis*, *G. squamosa*, *G. tai*, and several others (see *Gitanopsis* above). Members appear superficially more closely similar in some character states (e.g., of accessory flagellum, upper lip) to *Hourstonius* than to *Gitanopsis sens. str.*, but detailed analysis is beyond the scope of the present study.

Hourstonius vilordes (J. L. Barnard, 1962) (Fig. 3)

Gitanopsis vilordes Barnard, 1962: 131, fig. 6;— 1969b: 82;— 1975: 344, fig. 190;—Austin, 1985: 593;—Staudé, 1987: 379.

Material Examined:

ALASKA

SE Alaska, ELB Stns., 1961:

A3, Little Daykoo, Dall I. (54°42'N, 132°42'W); MW-LW, May 31 - 2 ♀♀, NMCC1992-0215.

BRITISH COLUMBIA.

Queen Charlotte Islands, ELB Stns., 1957:

W4b, Small bay, north shore Hippa Passage (53°27'N, 132°58'W), 6-10 m dredge, gravel, stones, shells, Aug. 10. - 1 ♀, NMCC1992-0204.

North Central coast, ELB Stns., 1964:

H3, Cockle Bay, Lady Douglas I. (52°21'N, 128°23'W), sand, *Zostera*, kelp, LW, July 9. - 4 ♀♀, NMCC1992-0219. H5, Hinks I., north end Aristazabal I. (52°38'N, 129°05'W), stones, *Phyllospadix*, kelp LW, July 10. - ♀ (ov.) (Fig'd specimen), 2 ♀♀; 3 ♂♂, 57 imm.; slide mounts: ♀♀ (1.8mm,

2.2 mm, 2.3 mm, 2.4 mm, 2.4 mm, 2.6 mm, 2.7 mm, 2.9 mm), NMCC1992-0220. H26, Cox Pt., inlet at mouth (53°08'N, 129°45'W), shelly sand, kelp, LW, July 19. - 2 ♀♀, NMCC1992-0225. H65, Christie Pass, cove on south side Hurst I. (50°50'N, 127°35'W), shelly gravel, kelp, MW-LW, Aug. 11. - 8 ♀♀, NMCC1992-0232.

Northern Vancouver I., ELB Stns., 1959:

O4, Browning Inlet (50°30'N, 128°06'W), shelly sand, eel grass, LW, July 19. - 1 ♀, NMCC1992-0213? V5, Lemon Pt., Nigei I. (50°51'N, 127°46'W), *Phyllospadix*, *Corallina*, fucoids, LW, Aug. 7. - 1 ♀, NMCC1992-0210. V7, Lady Ellen Pt., Broughton Str. (50°36'N, 127°07'W) - 1 ♀, NMCC1992-0211. V10, Alert Bay, Broughton Str. (50°35'N, 126°56'W) muddy sand, kelp, LW, Aug. 1 - 1 ♀, NMCC1992-0212. V17, Boat Bay, Cracroft I. (50°31'N, 126°34'W), coarse sand, eelgrass, LW, Aug. 5. - 3 ♀♀, NMCC1992-0217. V20, Brown Bay (50°10'N, 125°22'W), coarse sand, kelp, LW, June 22. - 1 ♂, 2 ♀♀, NMCC1992-0214. N11, Port Progress, Queen Charlotte Str. (50°55'N, 127°16'W), sandy mud, *Zostera*, LW, Aug. 4 - 3 ♀♀, NMCC1992-0205.

Southern Vancouver Island, ELB Stns., 1955:

F6, Telegraph Bay (48°27'N, 123°17'W) - 1 ♀ NMCC1992-0202. Victoria region (48°N, 123°W), KEC Stn.?, 1981. - 1 ♀, NMCC1992-0249; Ibid., - 3 ♂♂, 1 ♀ ov. (2.5 mm), slide mount, 10 females, NMCC1992-0250; Ibid., - 1 ♀, NMCC1992-0251.

Diagnosis: Female ov. (3.9 mm) (fig'd specimen).

Rostrum medium. Eye large, subreniform. Antennae short, subequal. Antenna 1, flagellum 5-6 segmented; accessory flagellum minute. Antenna 2, flagellum 6-segmented.

Upper lip, apex distinctly asymmetrical. Lower lip with weak inner "shoulders". Left mandible, lacinia 8-9 cusped; spine row with 10-12 slender blades; palp segment 3 distinctly longer than 2, inner distal margin finely pectinate, apex sharply acute.. Maxilla 1, inner plate with 7 apical spine teeth and 4-5 inner apical seta; palp and segments stout. Maxilla 2, plate medium, weakly armed. Maxilliped, plates narrow; palp segment 1 large, length nearly equal to 2 & 3 combined.

Coxa 1 narrow elongate; coxae 2-4 large deep, smooth below. Gnathopods 1 & 2 propods large, palms smoothly convex, nearly vertical, sharply demarcated at posterior angle by paired spines; dactyls slender, finely pectinate behind except on unguis. Gnathopod 1, carpal lobe spinose, produced 2/3 length of posterior margin of propod. Gnathopod 2, carpus narrow, lobe extending almost to posterior angle of propod.

Peraeopods 3 & 4 slender, weakly armed; dactyls slender. Coxae 5-7 normally posterolobate, margins unarmed. Peraeopods 5-7 regularly and subequally

homopodous; bases regularly expanded, posteriorly slightly increasing in size; dactyls slender, medium long.

Pleon side plates 2 & 3, hind corners weakly acuminate. Pleopod rami slightly longer than peduncle, 7-8 segmented. Uropod 1, rami markedly unequal, margins weakly spinose. Uropod 2, ramus marginally short-spinose; outer ramus \approx 1/2 inner. Uropod 3, rami short, broad, marginally smooth, slightly exceeding telson.

Telson elongate, smooth, apex narrowly rounded.

Brood plates medium broad; plate 5 with 10-12 distal marginal setae.

Distribution: Shallow littoral depths from SE Alaska to southern Vancouver Island, south to central and southern California.

Remarks: In character state similarity, *Hourstonius vilordes* appears somewhat closer to species of *Hourstonius* from the Gulf of Mexico than to species of "*Gitanopsis*" (*sens. lat.*) described by Hirayama (1983) from Japanese coastal marine waters (see key to species, p. 9). *H. vilordes* differs from the Hawaiian species, *H. pele* (Barnard, 1970), in its larger coxal plate 2, larger mandibular palp, and narrower telson, as well as character states of the gnathopods given in the key.

Amphilochus Bate (restricted)

Amphilochus Bate, 1862: 107.—Stebbing 1906: 149 (part);—Lincoln 1979: 148 (part);—Krapp-Schickel 1982: 74 (part);—Barnard & Karaman 1991: 96 (part).

Type species. *Amphilochus manudens* Bate, 1862, monotypy.

Species: *Amphilochus tenuimanus* Boeck, 1871; *A. planierensis* Ledoyer, 1977.

Diagnosis: Rostrum medium; anterior head lobe acute; eyes rounded. Antennae subequal in length; accessory flagellum lacking or minute.

Upper lip, apical incision shallow, lobes sub-symmetrical. Lower lip, inner margins smooth. Mandible: molar very reduced, knob-like, lacking triturating ridges; spine-row medium; palp segment 3 elongate. Maxilla 1 normal, palp 2-segmented. Maxilla 2 regular, outer plate slender. Maxilliped palp slender.

Coxal plates 2-4 large, lower margins serrate. Gnathopods 1 & 2 medium to strongly subchelate, palmar

KEY TO NORTHERN PACIFIC AND ATLANTIC SPECIES OF *APOLOCHUS*

(see character states of subgroups 1 & 2 of Fig. 4, p. 64)

1. Mandibular molar small, knob-like, lacking triturating ridges; maxilla 2, plates reduced, weakly armed; peraeopods 3 & 4, dactyls short, thick (North American Pacific subgroup). 2.
Mandibular molar distinct, apex acute with few triturating ridges, or flat, with several ridges; maxilla 2, inner plate broad; peraeopods 3 & 4, dactyls usually slender, medium (Atlantic-Mediterranean regional subgroup). 4.
 2. Gnathopod 2, carpal lobe short, $< 1/2$ propod margin; mandibular spine-row 10-12 bladed; uropod 2, rami nearly bare; telson elongate, $2 \frac{1}{2}X$ width *A. litoralis* (Stout) (p. 16)
Gnathopod 2, carpal lobe long, reaching posterior palmar angle; mandibular spine row long, 14-16 bladed; uropod 2, rami marginally spinose; telson shorter, length $2X$ width 3.
 3. Antenna 1 shorter than 2; gnathopod 2, palm shallowly convex, nearly perpendicular; maxilliped outer plate wide, little longer than broad *A. barnardi*, n. sp. (p. 18)
Antennae 1 & 2 short, subequal in length; gnathopod 2, palm strongly convex, oblique; maxilliped, outer plate medium, longer than wide *A. stauderi*, n. sp. (p. 19)
 4. Mandibular molar elongate, apex subacute, with few (or no) triturating ridges; gnathopod 2, carpus short, $< 1/3$ anterior margin of propod 5.
Mandibular molar short, apex sub truncate, flat, with several triturating ridges; gnathopod 2, carpus medium, length $> 1/3$ anterior margin of propod. 7.
 5. Gnathopod 2, propod large, carpal lobe extending almost to palmar angle; accessory flagellum very minute or lacking *A. picadurus* (J. L. Barnard)
Gnathopod 2, propod medium to small, carpal lobe extending little more than half way to palmar angle; accessory flagellum distinct, 1-segmented 6.
 6. Uropod 3, rami subequal; maxilliped, outer plate broader than long *A. borealis* (Enequist)
Uropod 3, inner ramus distinctly longer than outer ramus; maxilliped outer plate longer than broad. *A. pillaii* (Barnard & Thomas)
 7. Antennae subequal in length; coxa 1 serrate below; mandibular spine-row with 8-10 blades 8.
Antenna 1 short flagellum little beyond peduncle of A2; coxa 2 smooth below; mandibular spine row with ~14 blades *A. neopolitanus* complex, N-E. Atlantic 9.
 8. Gnathopod 2, propod with 4 stout antero-marginal spines *A. casahoya* (McKinney)
Gnathopod 2, propod with 2 stout antero-marginal spines *A. delacaya* (McKinney)
 9. Uropod 2, ramal margins spinose; coxa 1 subrectangular, lower margin smooth; telson short, length $1.5X$ maximum width *A. neopolitanus* (Della Valle) (fide Krapp-Schickel)*
Uropod 2, margins of rami nearly unarmed; coxa 1 subtriangular, lower margin with distinct notch; telson regular, length about twice width *Apolochus* sp. (= *A. picadurus* Krapp-Schickel, 1982).
-
- margin not demarcated from posterior margin by paired spines; carpus medium, lobe variously produced; dactyls finely denticulate. Peraeopods 3-4, dactyls slender, medium long. Coxae 5-7 deep, shallowly posterolobate. Peraeopods 5-7, dactyls slender, medium long.
- Pleon segment 3, hind corner with small cusp. Pleopods regular. Uropod 3, inner ramus slightly broadened. Telson elongate, narrowing distally, apex acute, minutely dentate.

* "*Amphilochus*" *neopolitanus* of Lincoln (1979) differs from that of Krapp-Schickel (1982)

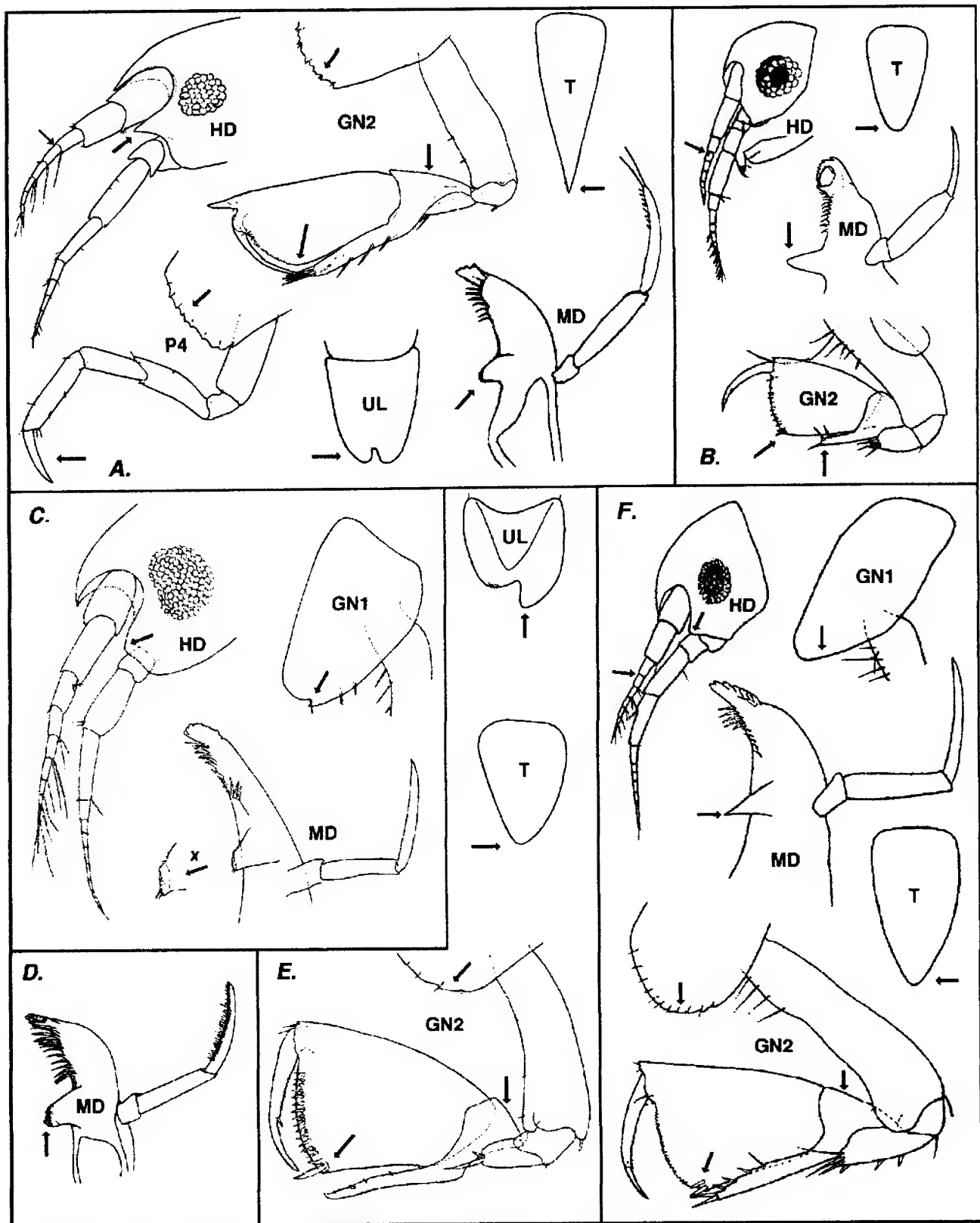


Fig. 4. Selected Characters and Character States within *Amphilochus* and *Apolochus*. A. *Amphilochus manudens* Bate [modified from Lincoln (1979), Sars (1895)]; B. *Apolochus borealis* (Enequist, 1950); C. *Apolochus* sp. [= *A. picadurus* (Krapp-Schickel (1982))]; D. *Apolochus delacaya* (McKinney, 1978). E. *Apolochus neopolitanus* Della Valle (after Krapp-Schickel (1982)); F. *Apolochus picadurus* (Barnard, 1962). [see p. 28 for figure legend]

Distribution: Northern North Atlantic, N. American [Brunel et al. 1998] and boreal European-Mediterranean region.

Habitat: On scleractinian and horny corals, 0-600 m.

Remarks: *Amphilochus* Bate (sens. str.) is defined by: anterior head lobe acute; accessory flagellum lacking; upper lip apical lobes subsymmetrical; gnathopod propods lacking posterodistal palmar spines; coxae 2-4 with serrate lower margins; peraeopod dactyls elongate; and telson apically acute, minutely tridentate.

The form of the gnathopods, mouthparts, and telson suggest that *Amphilochus sens. str.* may have been para-ancestral to regionally more advanced genera such as *Amphilochoides* Sars, 1895, and *Paramphilochoides* Lincoln, 1979. However, these latter two genera may themselves require redefinition. Thus, the type species of *Amphilochoides* [*A. boeckii* Sars (= *A. odontonyx* Sars, 1895)] possesses a unique combination of generic-level character states: upper lip, apical lobes subsymmetrical; maxilla 2 plates small, partly fused; dactyls of both gnathopod 1 & gnathopod 2 with proximal nodiform process; and epimeral plate 3, hind corner toothed. At least three species with normally reduced mandibular molar, presently included in the genus *Amphilochoides* by Barnard & Karaman (1991), differ in the above character states. Thus, "*Amphilochoides*" *longimanus* Chevreux, 1888, *A. serratipes* Norman, 1869, and a distinctive Mediterranean species figured as *A. serratipes* by Krapp-Schickel (1982) might justify separate generic recognition.

Despite aberrancies in the form of the gnathopods, in overall character-state similarity the genus *Paramphilochus* Ishimaru & Ikehara, 1986, appears more closely similar to Pacific members of *Apolochus* and *Hourstonius* than to *Amphilochus* (sens. str.).

***Apolochus*, new genus**

Amphilochus Sars 1895: 215 (part); Stebbing 1906: 149(part);—Barnard 1969a: 136(part);—Lincoln 1979: 148 (part);—Krapp-Schickel 1982: 74 (part); Barnard & Karaman 1991: 96 (part).
non: *Amphilochus* Bate, 1862: 107.

Type species: *Amphilochus neopolitanus* Della Valle, 1893.

Species: 1. Nominate subgroup: *Apolochus picadurus* (Barnard, 1962) (California); *Apolochus* species (= *A.*

picadurus Krapp-Schickel, 1982) (Mediterranean); *A. borealis* (Enequist, 1950) (NW Europe); *A. pillaii* (Barnard & Thomas, 1983) (Florida); *A. casahoya* (McKinney, 1978) (Gulf of Mexico); *A. delacaya* (McKinney, 1978) (Gulf of Mexico); *A. kailua* Barnard, 1970 (Hawaii); *A. likelike* Barnard, 1970 (Hawaii); *A. menehune* Barnard, 1970 (Hawaii).

2. Eastern Pacific subgroup: *Apolochus litoralis* (Stout, 1912) (p. 16); *A. barnardi*, new species (p. 18); *A. staudei*, new species (p. 19).

3. Mediterranean "southern" subgroup: *Apolochus brunneus* (Della Valle, 1893), *A. spencebatei* (Stebbing, 1876), and two species described from the Indian Ocean region as *Amphilochus neopolitanus* by Ledoyer 1978, 1979.

Diagnosis: Anterior head lobe rounded. Antenna 1 short to medium, peduncular segments 1 & 2 slightly broadened posteriorly; accessory flagellum 1-segmented, rarely lacking.

Upper lip, apical lobes asymmetrical. Lower lip, inner margins variously "notched". Mandible, molar reduced, apically with few triturating ridges, setae, or none; spine-row well developed; palp segment 3 little longer than segment 2. Maxilla 1, outer plate spines regular; palp segment 1 enlarged. Maxilla 2, setation of plates tending to reduction. Maxilliped outer plate broad, palp regular.

Coxae 2-4 weakly or not serrate below. Gnathopod 2, carpus short to medium in length, posterior lobe well developed; palmar margin of propod distinct, steeply oblique or nearly vertical, palmar angle defined by 1-2 spines. Peraeopods 3 & 4, dactyls short to medium, shorter than those of peraeopods 5-7.

Telson linguiform, apex sharply rounded or subacute. Brood plate (P5) short, with 5-6 marginal setae.

Etymology: A combining form of "apo" and "lochus", referring to the generally advanced nature of the character states of the genus.

Remarks: The genus *Amphilochus* Bate, 1862 (sens. lat.), previously encompassed a heterogeneous group of amphilochid species characterized by stoutly subchelate gnathopods and reduced, essentially non-tritulative, mandibular molar process. Characters and character states previously utilized in diagnoses and keys (above) have been limited in number and kind, and apparently not previously ordered or subject to numerical analysis.

A semi-phyletic phenogram of northern hemisphere

species of *Amphilocheus* (sens. lat.) (see p. 9, supporting data supplied on request) suggests that the name *Amphilocheus* is more realistically confined to the type species *Amphilocheus manudens* Bate, 1862, *A. tenuimanus* Boeck, 1871, and (less closely) *A. planierensis* Ledoyer, 1977.

Apolochus litoralis (Stout)
(Fig. 5)

Amphilocheus litoralis Stout, 1912: 136, fig. 78;—Barnard 1962: 82;—Barnard 1969b: 124, fig. 2;—Barnard 1975: 358, fig. 327;—Stauder 1987: 379;—Barnard & Karaman 1991: 96.

Material Examined: 32 lots of specimens containing about 80 specimens (mostly ovig. females but also incl. 6 males and a few imm.), mostly from high salinity outer coast stations, from about Sitka, SE Alaska, southward through the Queen Charlottes Islands, the north-central B. C. coast, Vancouver I., Washington state, to southern California.

ALASKA

SE Alaska, ELB Stns.,

1961:

A168, Klokachef I., Chickagof I. (57°25'N, 135°52'W), kelp over boulders, LW, July 24. - ♀ ov. (damaged), NMCC-1992-0217. A175, West Eugenia Pt., San Juan Batista I. (55°26.44'N, 133°17.18'W), *Zostera*, algae, sand, rock, LW, July 26. - 1♂, 1♀, NMCC1992-0218.

1980:

S5B1, N.W. end Hogan I., west cove (57°43'N, 136°15.5'W) prganic debris, slatey gravel, LW July 28. - 1♀, NMCC1992-0245. S23F1, Taigud I., south beach, Baranof I. (56°54.5'N, 135°24'W), kelp, sand, LW, Aug. 4. - 3♀♀ + 2♀♀ (damaged), NMCC1992-0247.

BRITISH COLUMBIA

Queen Charlotte Ids., ELB Stns., 1957:

H2, Parry Passage, E. of Kiusta (54°10'N, 133°01'W), *Phyllospadix*, kelp, over coarse sand, LW, Aug. 24. - 1♀, NMCC-1992-0203.

Northcentral coast, ELB Stns., 1964:

H5, Hinks I., N. end Aristazabel I. (52°38'N, 129°05'W), *Phyllospadix*, kelp, LW, July 9. - 1♀, NMCC-1992-0220. H20, McCauley I., N. end (53°43'N, 130°15'W), fine sand, LW, July 17. - 2♀♀, NMCC1992-0221. H47, Codfish Passage, Miles I. (52°05'N, 128°19'W), *Zostera*, kelp, algal mats, coarse shelly sand, LW, Aug. 5. - 1♂, 5♀♀, NMCC-1992-0221. H50, Goose I. South beach (51°57'N, 128°26'W), *Zostera*, algae, fine shell, sand, Aug. 6. - 1♀, NMCC1992-0229. H57, cove off Nolan Pass, S. end Hunter I. (51°43'N, 128°05'W), shells, gravel, mud, LW, Aug. 8. - 2♀♀,

NMCC1992-0231. H65, Christie Pass, cove on S. side Hurst I. (50°50'N 127°36'W), kelp, shelly gravel, LW, Aug 11. - 1♀, NMCC1992-0232.

Northern Vancouver I., ELB Stns., 1959:

O3, Grant Bay, Quatsino Sound (50°28'N, 128°05'W), coarse shelly sand, LW, July 18. - 3♀♀, NMCC1992-0209. O11, Hesquiat, at Matlakaw Pt. (49°23'N, 126°28'W), *Phyllospadix*, kelp, over gravel - 1♀, NMCC1992-0208. N11, Port Progress (50° 55'N, 127°16'W), *Zostera* over sandy mud, stones, LW, Aug. 4. - 1♀, NMCC1992-0205. V5, Lemon Pt., Nigei I. (50°51'N, 127°46'W), *Phyllospadix*, fucoids, *Corallina*, over stones, LW. - 6♀♀, NMCC-1992-0210. V4b, Roller Bay, Hope I. (50°56'N, 127°56'W), *Phyllospadix*, kelp, coarse sand, LW, July 22. - 3♀♀. NMCC1992-0209.

Southern Vancouver I., ELB Stns.

1955: F1 Wiffen Spit, Sooke (48°21'N, 123°45'W), algae on gravel, stones, LW - 4♀♀, NMCC1992-0201.

1970: P718, Becher Bay at Head (48°21'N, 123°35'W), algae on stones, gravel, LW, July 31 - 1♀, NMCC1992-0234.

1977: B6a, Trial Island Pt., Victoria (48°24'N, 123°19'W) - 1♀, NMCC 1977-181.

1980: Deer I., Victoria region (50.6°N, 127.9°W?) - 2♀♀, NMCC1992-0244.

1981: Victoria region (48°N, 123°W), KEC Stn.? - 4♀♀, NMCC1992-0234?; Ibid. - 1♂, 3♀♀, NMCC1992-0248; Ibid. - 1♂, 1♀, NMCC1992-0249; Ibid. - 4♂♂, 1♀, NMCC1992-0251.

Vancouver I., outer coast, ELB Stns.

1976:

B4, off Brady's Beach, Bamfield (48°50.03'N, 125°08'W), sand, algae, 60-70 m dredge, June 25 - 2♀♀, NMCC1992-0235. B5, Brady's Beach, S. side (48°49.08'N, 125°08'W), *Phyllospadix*, kelp, fucoids, on sand and rock, LW. - 3♀♀, NMCC1992-0236. B7, Broken Islands, W. side of Wouwer I. (48°51.6'N, 125°21'W) *Phyllospadix*, kelp, on bedrock, LW. - 1♀, NMCC1992-0237.

1977:

B8, off Brady's Beach, Bamfield (48°49.6'N, 125°09.2'W), sand and algae, 5-10 m dredge, May 21. - 3♀♀, 2 imm., NMCC1992-0239. B13, Trevor Channel, off Brady's Beach (48°52'N 125°08'W), hard sand algae, 6-14 m dredge, May 25. - 1♀, NMCC1992-0290. B14, Trevor Channel off Execution Rock (48°48'N, 125°11.2'W), sandy mud, algae, 44-54 m dredge, May 25. - 1♀, NMCC1992-0241. B21b, off Brady's Beach, Bamfield (48°49.6'N, 125°09.2'W). sand, algae, 10-20 m dredge, June 1. - ♀ (2.8 mm) (**fig'd specimen**); 10♀♀, NMCC1992-0242.

US MAINLAND

Washington-Oregon, ELB Stns., 1966:

W36, Clallam Bay, WA, at river mouth (48°15'N, 124°16'W), fine organic sand, *Phyllospadix*, *Chorda*, LW - 1♀, NMCC-1992-0233.

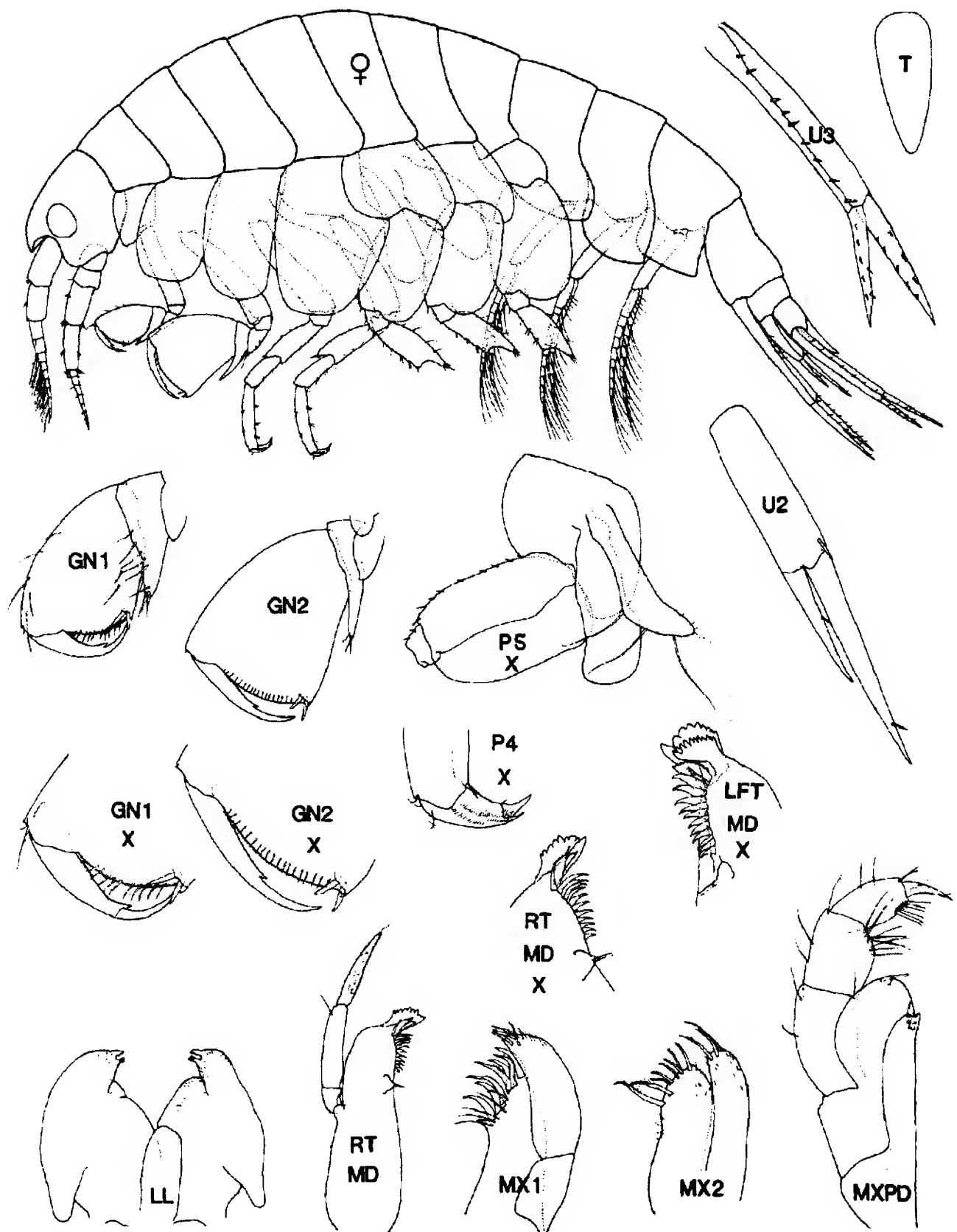


Fig. 5. *Apolochus litoralis* (Stout). Female ov. (2.8 mm). Off Brady's Beach, Vancouver I., B. C.

Diagnosis: Female ov. (4.0 mm) (fig'd specimen).

Rostrum strong, apex little deflexed. Eye medium, nearly round. Antennae short, subequal, flagella 7-8 segmented; accessory flagellum 1-segmented.

Mandible: molar a small triangular knob, apex with two setae; left mandible, lacinia 9-10 cusped; incisor 9-dentate; spine row with 10-12 slender blades, stoutest distally; palp segment 3 little longer than 2, inner margin finely pectinate, apex blunt, with single short seta. Maxilla 1, inner plate, apex oblique, with 7 curved spine-teeth and 4-5 setae at inner angle; palp stout, segment 1 large. Maxilla 2, plates medium, inner plate with 8 apical setae. Maxilliped, inner plate narrow, apex subtruncate; outer plate broad inner margin smooth; palp segment 1 large, segment 2 extending considerably beyond outer plate.

Coxa 1 short, little concealed by coxa 2; coxae 2-4 large, deep, smoothly rounded below. Gnathopods 1 & 2 strongly subchelate. Gnathopod 1 much smaller; propod, palmar margin convex; oblique; dactyl stout, smooth behind, unguis medium; carpus short, posterior lobe short, anteriorly spinose-setose. Gnathopod 2, propod large, expanding distally, palm shallowly convex, nearly vertical, sharply demarcated at posterior angle by paired spines; dactyl stout, smooth behind, unguis medium; carpus short, posterior lobe short, nearly base, produced 1/3 length of posterior margin of propod.

Peraeopods 3 & 4 ordinary, posterior margin of segment 6 with 3 spines; dactyls short. Coxae 5-7 normally posterolobate, margins unarmed. Peraeopods 5-7 regularly and subequally homopodous; bases regularly expanded, posteriorly slightly increasing in size; segment 4 not elongate; dactyls short.

Pleon side plate 2 convex below, 3 nearly straight, corners not produced. Pleopod rami long, 9-10 segmented. Uropod 1, rami subequal, margins weakly spinose. Uropod 2, rami slender, nearly bare, outer ramus > 1/2 inner. Uropod 3 elongate, rami unequal, marginally spinose, greatly exceeding telson. Telson smooth, length about twice width, apex narrowly rounded.

Brood plates medium broad; 5 with 2-3 distal marginal setae.

Distribution: Intertidal and LW habitats, from southern California, north through Oregon, Washington, and B. C. to southern S.E. Alaska,

Taxonomic Commentary: As indicated in the key, *Amphilochus litoralis* and other American Pacific coast

species are distinct from North Atlantic and Gulf species.

Apolochus barnardi new species
(Fig. 6)

Amphilochus ?neopolitanus cf. Della Valle *vide* Barnard, 1962: 126;—Barnard 1964: 105(?)—Barnard 1969b: 82.

Material Examined: None.

Diagnosis (partly after Barnard 1962): Female ov. (2.5 mm): Rostrum medium. Eye medium, narrowly subovate. Antennae medium short, subequal. Antenna 1, peduncular segments 1 & 2 short and deep, 2 with posterodistal tuft of setae; 3 small, narrow; flagellum 8-9 segmented; accessory flagellum minute. Antenna 2, flagellum 9-10 segmented.

Mandibular molar small, broadly triangular. Left mandible, lacinia 8-9 cusped; spine row with 15-17 slender blades, distinctly largest distally; incisor multidentate; palp segment slightly longer than 2, inner margin finely pectinate, apex with single short seta. Maxilla 1, apical margin of inner plate nearly vertical, with 7 spine-teeth and 6-8 setae at inner angle; palp segments stout, segment 1 large. Maxilla 2, plates medium, inner plate with 6 marginal setae, proximally plumulose. Maxilliped, inner plates tall, narrow, apex subtruncate; outer plate short, broad, distal margin with several setae and stout spine, inner margin smooth; palp segment 2 distinctly exceeding outer plate; segment 3, inner distal margin with narrow denticles.

Coxa 1 short, little occluded by 2; coxae 2-4 successively deepening, rounded below. Gnathopods 1 & 2 distinctly subchelate. Gnathopod 1, propod slightly expanding distally, palm convex, oblique; dactyl slender body denticulate behind, unguis elongate, slightly exceeding palmar angle; carpus narrow, lobe medium, extending about 1/2 posterior margin of propod. Gnathopod 2, propod large, broadening distally, palm convex, finely crenulate, nearly vertical, sharply demarcated at posterior angle by paired spines; dactyl slender, body finely pectinate behind, unguis elongate slightly exceeding palm; carpus short, posterior lobe elongate extending length of posterior margin of propod.

Peraeopods 3 & 4 medium, segment 6 with 4 posterior marginal spines; dactyls short, unguis short. Coxae 5-7 normally posterolobate, hind lobes rounded below, posteroventral margin of 7 weakly spinose. Peraeo-

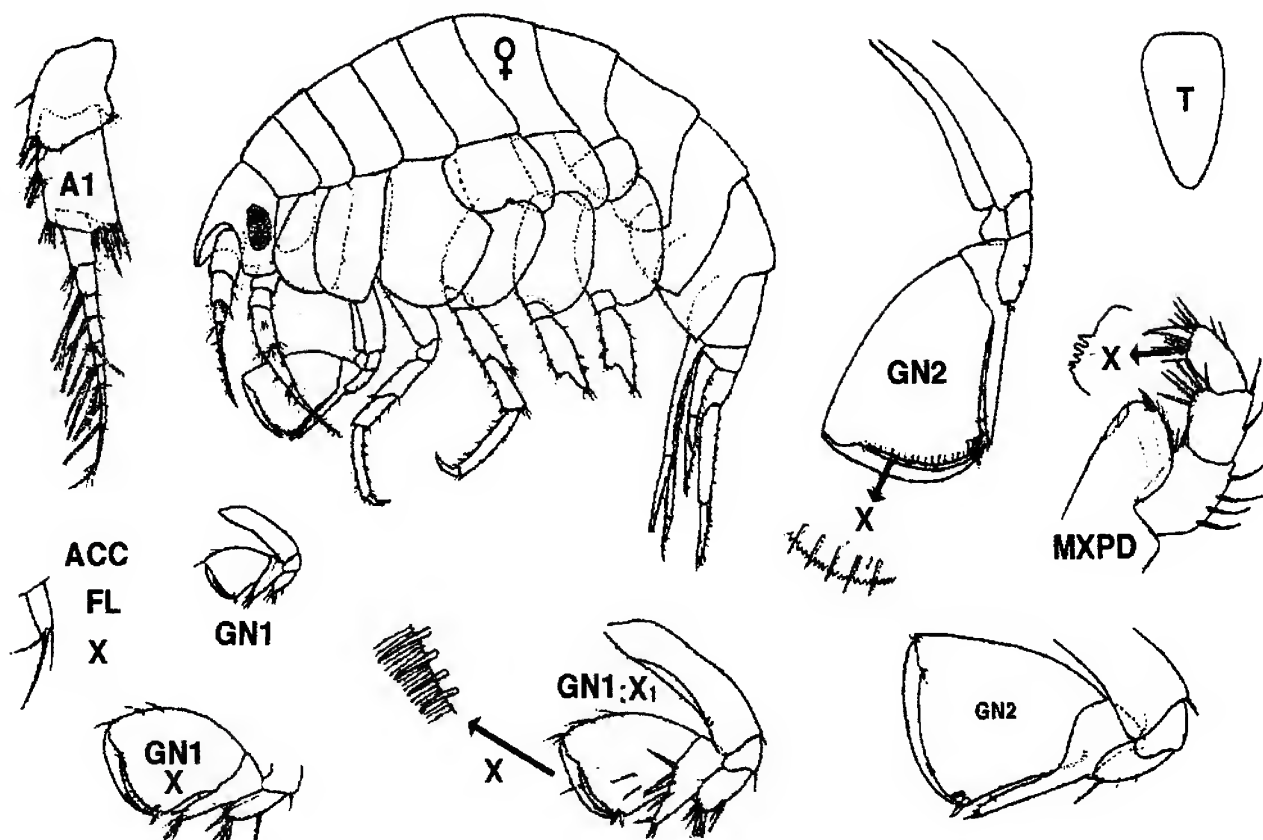


Fig. 6. *Apolochus barnardi*, new species (= *A. neopolitanus* cf. Della Valle fide J. L. Barnard, 1962) (modified from Barnard, 1962).

pods 5-7 regularly homopodous; bases regularly expanded, posteriorly slightly increasing in size; segment 4 not elongate; distal segments marginally spinose, esp. anteriorly; dactyls short.

Pleon side plates 2 & 3 convex below, hind corners not acuminate. Pleopod rami distinctly longer than peduncle, 9-10 segmented. Uropod 1 slender, rami unequal, margins spinose. Uropod 2, rami marginally short-spinose; outer ramus $< 1/2$ inner. Uropod 3 elongate, greatly exceeding telson; rami medium, unequal, marginally spinose. Telson subtriangular, length slightly less than twice width, apex narrowly rounded.

Brood plates medium broad, 5 narrow.

Distributional Ecology: *Apolochus barnardi* occurs in the *Phyllospadix* and *Egregia* sublittoral zone to depths of ~20 m, mainly on bottoms of coralline algae, stones, and sessile invertebrates, from Central to Southern California.

Etymology: The name is a tribute to the early recognition of this distinctive form by the late J. L. Barnard, and to his major contributions to knowledge of the North American Pacific amphipod fauna.

Remarks: *Apolochus barnardi* is distinct from *A. neopolitanus* DellaValle 1893, as figured by Krapp-Schickel (1982) in characters of the key (p. 13). It is also distinguished from *A. staudei* by characters of the key and as noted elsewhere (below).

Apolochus staudei new species
(Fig. 7)

Amphilochus neopolitanus Della Valle, fide Staude, 1987: 379, fig. 18.40?;—Austin 1985: 593.

non: *Amphilochus neopolitanus* cf. Della Valle fide Barnard 1962 (California).

Material Examined: 15 specimens at 7 stations:

BRITISH COLUMBIA

North central coast, ELB Stns., 1964:

H12, Stephens I., NW end (54°11'N, 130°48'W), *Phyllospadix*, kelp, LW, July 13. - 1 ♀; NMCC1992-0222. H20, McCauley I., NH end (53°43'N, 130°22'W), fine sand, LW, July 17 - 2 ♀♀, NMCC1992-0221. H21, N. end Banks I. (53°25'N, 130°10'W), 40-60 m. - 1 ♂; 2 ♀♀; NMCC1992-0223. H22, 1/2 mile off Larsen Hd., Banks I. (53°34'N, 130°34'W), kelp on sand and shell, 20 m dredge. July 17. -

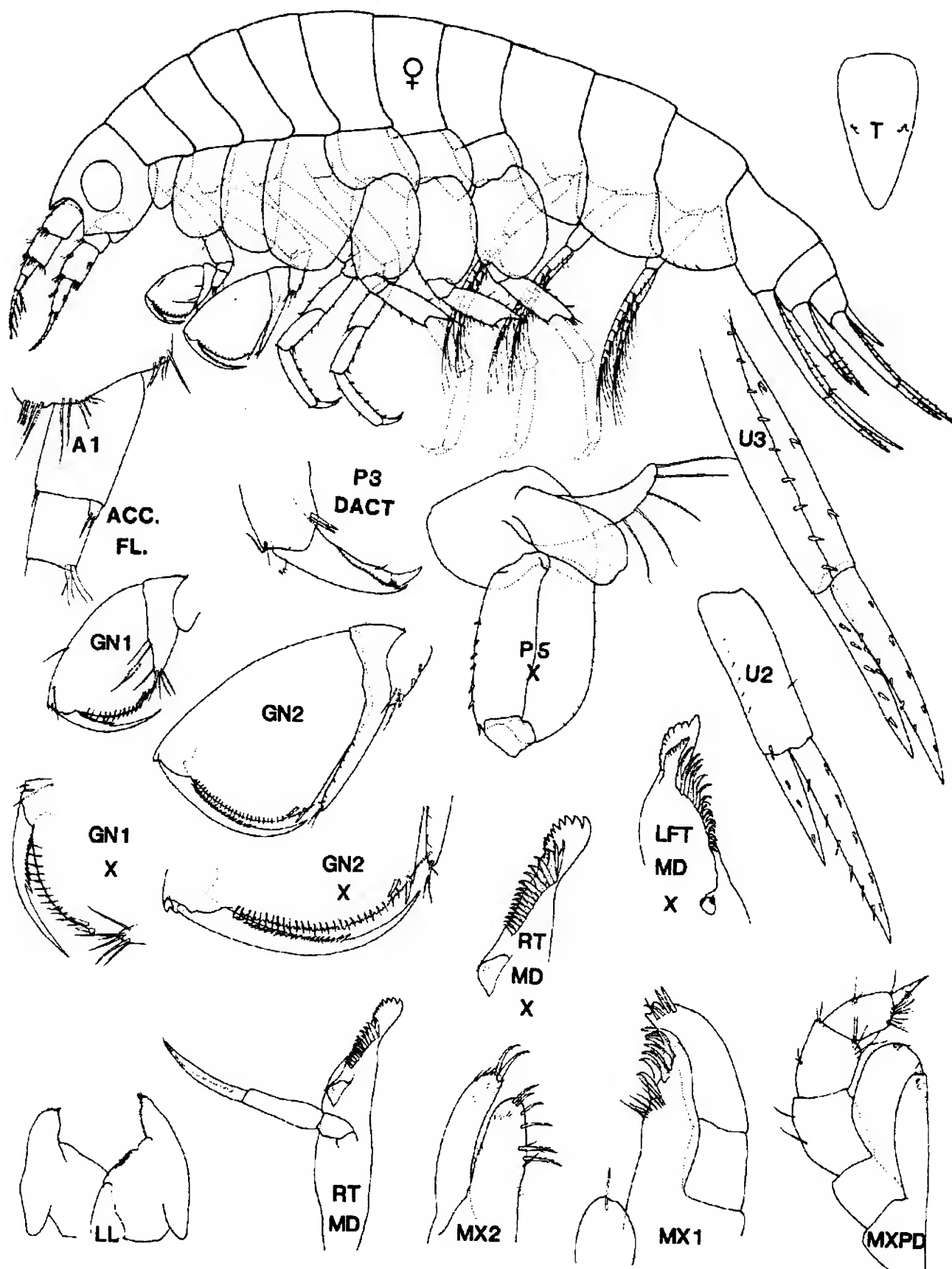


Fig. 7. *Apolochus staudei*, n. sp. Female ov. (2.4 mm) Holotype. N end of Rennison I., B. C.

1 ♀, 2 imm, NMCC-0224. H30, N. end of Rennison I. (52°51'N, 129°21'W), kelp and sand, 8-25 m dredge, July 20. - ♀ **Holotype** (slide mount); 34 ♀♀ **Paratypes**, 3 ♂♂ **Allotypes**, 9 im, **Paratypes**, NMCC1992-0226. H53, Townsend Pt., St. John Harbour (52°12'N, 128°28'W), *Phyllospadix*, kelp, *Corallina*, bedrock, LW, Aug. 7. - 1 ♀, NMCC1992-0230.

San Juan's Brown I., E. side, Queen Charlotte Str. (51°19'N, 127°46'W), 50-60 m dredge, FRB?, 1983. - 1 ♀, NMCC-1992-0253.

Diagnosis: Female ov. (2.4 mm) (holotype).

Rostrum medium. Eye large, subovate. Antennae short, subequal. Antenna 1, peduncular segment 1 & 2 short and deep, 3 small; flagellum 6-7 segmented; accessory flagellum minute. Antenna 2, flagellum 6-7 segmented.

Mandibular molar small, broadly triangular, with apical setules. Left mandible, lacinia 8-9 cusped; spine row with 15-17 slender blades, distinctly largest distally; incisor multidentate; palp segment slightly longer than 2, inner margin finely pectinate, apex with single short seta. Maxilla 1, apical margin of inner plate nearly vertical, with 7 spine-teeth and 6-8 setae at inner angle; palp segments stout, segment 1 large. Maxilla 2, plates medium, inner plate with 6 marginal setae, proximally plumulose. Maxilliped, inner plate tall, narrow, apex subtruncate; outer plate medium broad, tall, inner margin smooth; palp segment 2 only slightly exceeding outer plate.

Coxa 1 short, little occluded by 2; coxae 2-4 successively deepening, rounded below. Gnathopods 1 & 2 distinctly subchelate. Gnathopod 1, propod slightly expanding distally, palm convex, oblique; dactyl slender body denticulate behind, unguis elongate, slightly exceeding palmar angle; carpus narrow, lobe medium, extending about 1/2 posterior margin of propod. Gnathopod 2, propod large, broadening distally, palm convex, finely crenulate, nearly vertical, sharply demarcated at posterior angle by paired spines; dactyl slender, body finely pectinate behind, unguis elongate slightly exceeding palm; carpus short, posterior lobe elongate extending length of posterior margin of propod.

Peraeopods 3 & 4 medium, segment 6 with 4 posterior marginal spines; dactyls short, unguis short. Coxae 5-7 normally posterolobate, hind lobes acute below, margins unarmed. Peraeopods 5-7 regularly homopodous; bases regularly expanded, posteriorly slightly increasing in size; segment 4 not elongate; dactyls short.

Pleon side plates 2 & 3, gently convex below, hind corners not acuminate. Pleopod rami distinctly longer

than peduncle, 9-10 segmented. Uropod 1 slender, rami slightly unequal, margins weakly spinose. Uropod 2, rami marginally short-spinose; outer ramus >1/2 inner. Uropod 3 elongate, greatly exceeding telson; rami medium, unequal, marginally spinose. Telson narrowly triangular, length about twice width, apex sharply rounded.

Brood plates medium broad; plate 5 narrow, with 5-6 longish distal marginal setae.

Etymology: The species name recognizes Dr. Craig P. Staude, Friday Harbor Laboratories, for his outstanding contribution to knowledge of the systematics and ecology of amphipods of the northeastern Pacific marine region.

Distributional Ecology: Known only from the Queen Charlotte Sound coast of north central British Columbia south to northern Queen Charlotte Strait, LW and shallow sublittoral to 60 m in depth.

Remarks: Although most closely related to *A. barnardi*, *Amphilochus staudei* differs mainly in the form of the gnathopods, especially gnathopod 1, the distinctly posteriorly pectinate dactyls, the form of the maxilliped plates and palp, and the slightly longer and more acutely pointed telson.

DISCUSSION

Phyletic Reclassification

In phyletic revisions of the Gammaridea, family Amphilochidae has been placed within superfamily Leucothoidea (Bousfield 1979, 1982, 1983, 2000, 2001; Bousfield & Shih 1994). Lowry & Myers (2000) have recently proposed superfamily Iphimedioidea which combines former leucothoidean families Iphimediidae, Lafystiidae, and Laphystiopsidae with eusiroidean families Epimeridae and Amphithopsidae.

Remaining within Leucothoidea are families Leucothoidae, Anamixidae, Amphilochidae, Pleustidae, Stenothoidae, Thaumatelsonidae, and Cressidae. However, the Stenothoidae, Thaumatelsonidae, and Cressidae differ markedly in lacking a conspicuous rostrum, but exhibit sexually dimorphic gnathopods, strongly reduced maxilliped plates, frequent fusion of urosome segments and/or telson, and 2-segmented outer ramus of uropod 3. Furthermore, the gnathopods are frequently sexually dimorphic. Bousfield (2001b) formally utilizes the superfamily name Stenothoidea to encompass these three families. Based on the principal

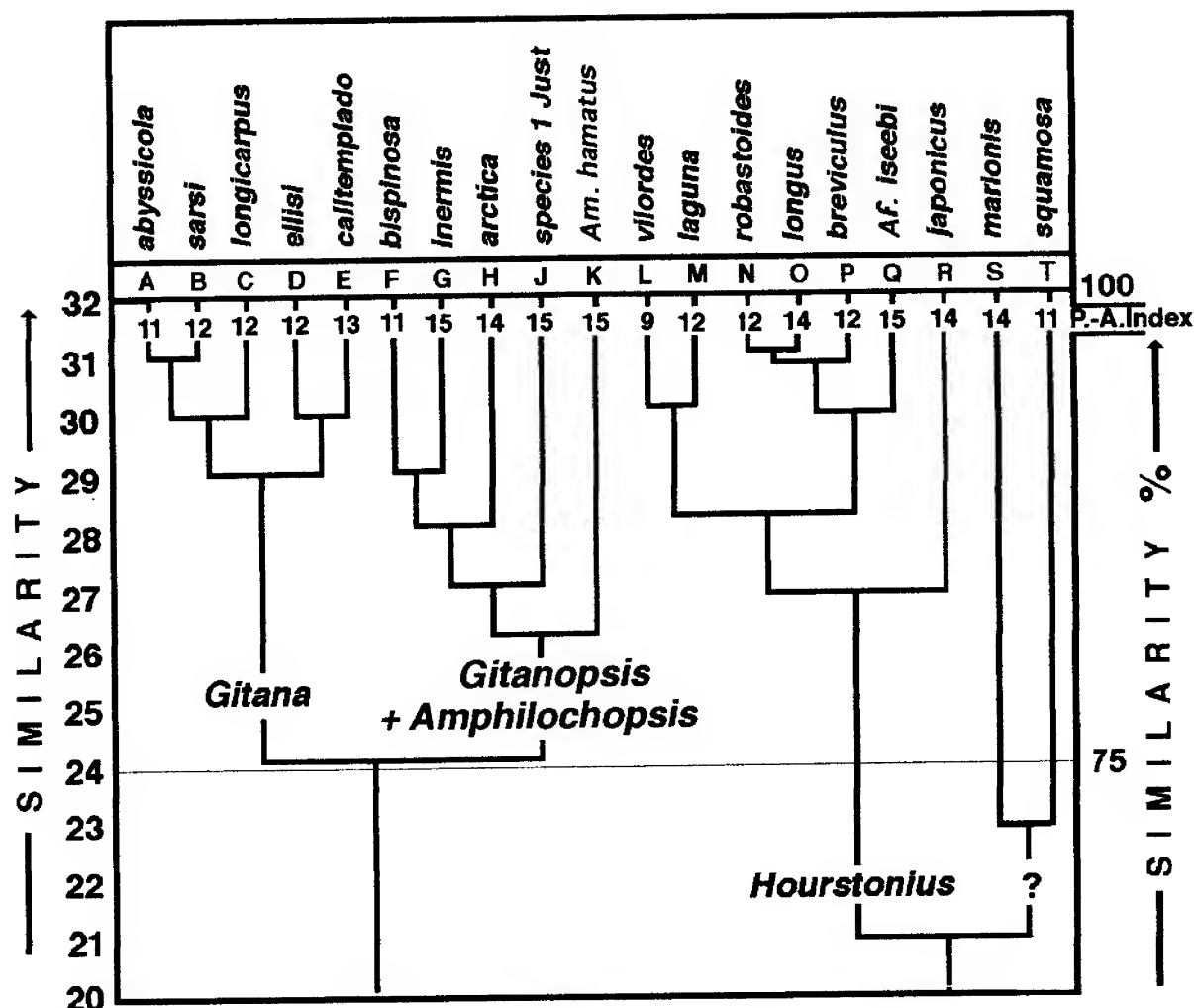


Fig. 8. Phenogram of morphological similarities and possible phyletic relationships within *Gitana*, *Gitanopsis*, and *Hourstonius*.

character state differences noted above, and pending further detailed analysis, the superfamily name Stenothoidea is herewith formally recognized. Family Amphilochoidea therefore remains within superfamily Leucothoidea.

Reorganization of genera

Taxonomic placement of species within northern hemispheric genera of amphilochoid amphipods has long been unsatisfactory. Difficulties encountered, and partial generic revisions attempted by Lincoln (1979), Karaman (1980), and to some extent Krapp-Schickel (1982) and Hirayama (1983), are reflected in the number of character state "variables" specified by Barnard & Karaman (1991), especially within the genera *Gitana*, *Gitanopsis*, *Amphilochoidea*, and *Amphilochoopsis*. Likewise, the present study encountered a persistence of unsatisfactory taxonomic categorizations within North Pacific species, and absence of previous numerical analysis. The authors have here attempted a

realignment of species on more comprehensive and more natural generic conceptualizations.

The present treatment of species and genera utilizes a semi-phyletic modification of the UPGMA system of Sneath & Sokal (1973), as in previous analysis of other North Pacific amphipod groups (e.g., Jarrett & Bousfield 1994; Bousfield & Chevrier 1996). Character states are ordered plesio-apomorphically and relative phyletic placement of a taxon is represented by a numerical sum of plesiomorphic, intermediate, and apomorphic character states values (0, 1, and 2, resp.) in a Plesio-Apomorphic (P.-A.) Index. Tabular data on which the resulting phenograms are based are considered overly bulky and repetitive for publication here, but may be supplied on request.

Fig. 8 graphically portrays morphological similarities within species of *Gitana*, *Gitanopsis* sens. str. (effectively encompassing the arctic monotypic genus *Amphilochoopsis*), and boreal-warm temperate, North Pacific and North Atlantic species of *Gitanopsis* (=

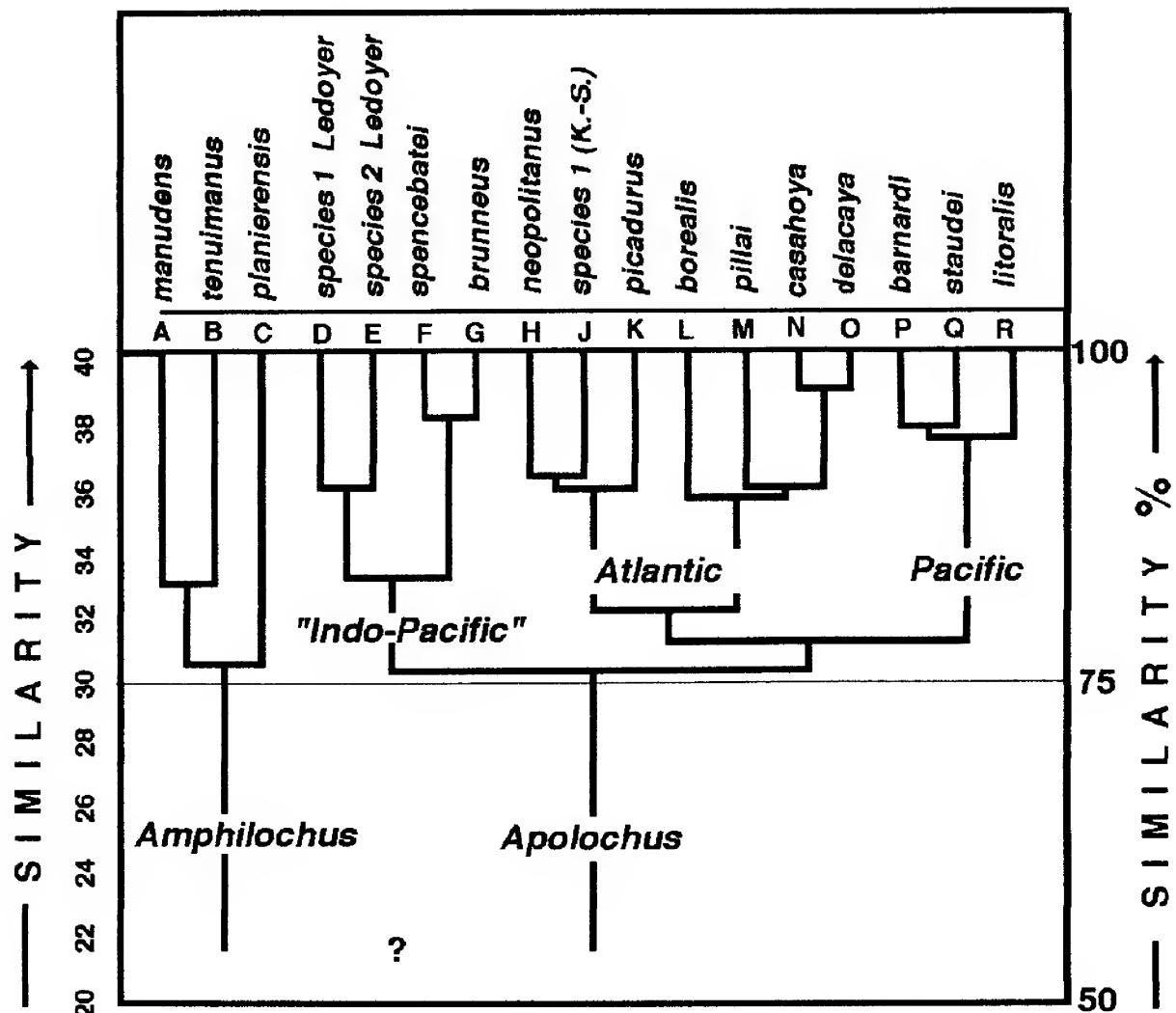


Fig. 9. Phenogram of morphological similarities and possible phyletic relationships within the genera *Amphilochus* and *Apolochus*.

Hourstonius). Species groupings are distinct above the 75% similarity level within *Gitana*, *Gitanopsis sens. str.*, and *Hourstonius*. The former two genera cluster at about the 75% similarity level, with the genus *Amphilochopsis* somewhat intermediate between the two. However, the genus *Hourstonius* remains distinct below the 60% similarity level. The eastern Pacific species, *H. vilordes* (J.L. Barnard) is similar to species of both the western Pacific and Caribbean (Gulf of Mexico) regions, described mainly by Hirayama and McKinney, respectively. Not unexpectedly it is relatively remote from species of the South Atlantic (e.g., *H. magdai*, *H. squamosa*) described elsewhere.

This limited analysis tends to validate generic realignment of species within *Gitanopsis* Sars, 1895, and formal recognition of the generic concept *Hourstonius*. However, further study of relationships of species of the southern hemisphere, and of groups commensal with crustaceans, is clearly needed.

Fig. 9 portrays character state similarities within the North Atlantic genus *Amphilochus* Bate (*sens. str.*), based on the type species *A. manudens*, and species of the boreal-warm-temperate North Pacific, North Atlantic and Mediterranean-Indo-Pacific regions (= *Apolochus*, n. g.). Species groupings are distinct above the 75% similarity level within both groups, but the two genera remain distinct below the 50% similarity level. *Apolochus* here encompasses three subgroups: (1) an eastern Pacific complex of *A. litoralis* (Stout, 1912) and two closely similar species newly described herein; (2) a more speciose, essentially Atlantic (Caribbean-Mediterranean) subgroup encompassing *A. neopolitanus* Della Valle, *A. picadurus* (J. L. Barnard) and several superficially similar species [e.g., figured but unnamed by Lincoln (1979), Krapp-Schickel (1982)]; and (3) a Mediterranean Indo-Pacific subgroup encompassing *A. brunneus*, *A. spencebatei* and species attributed to "*A. neopolitanus*" by Ledoyer (1977).

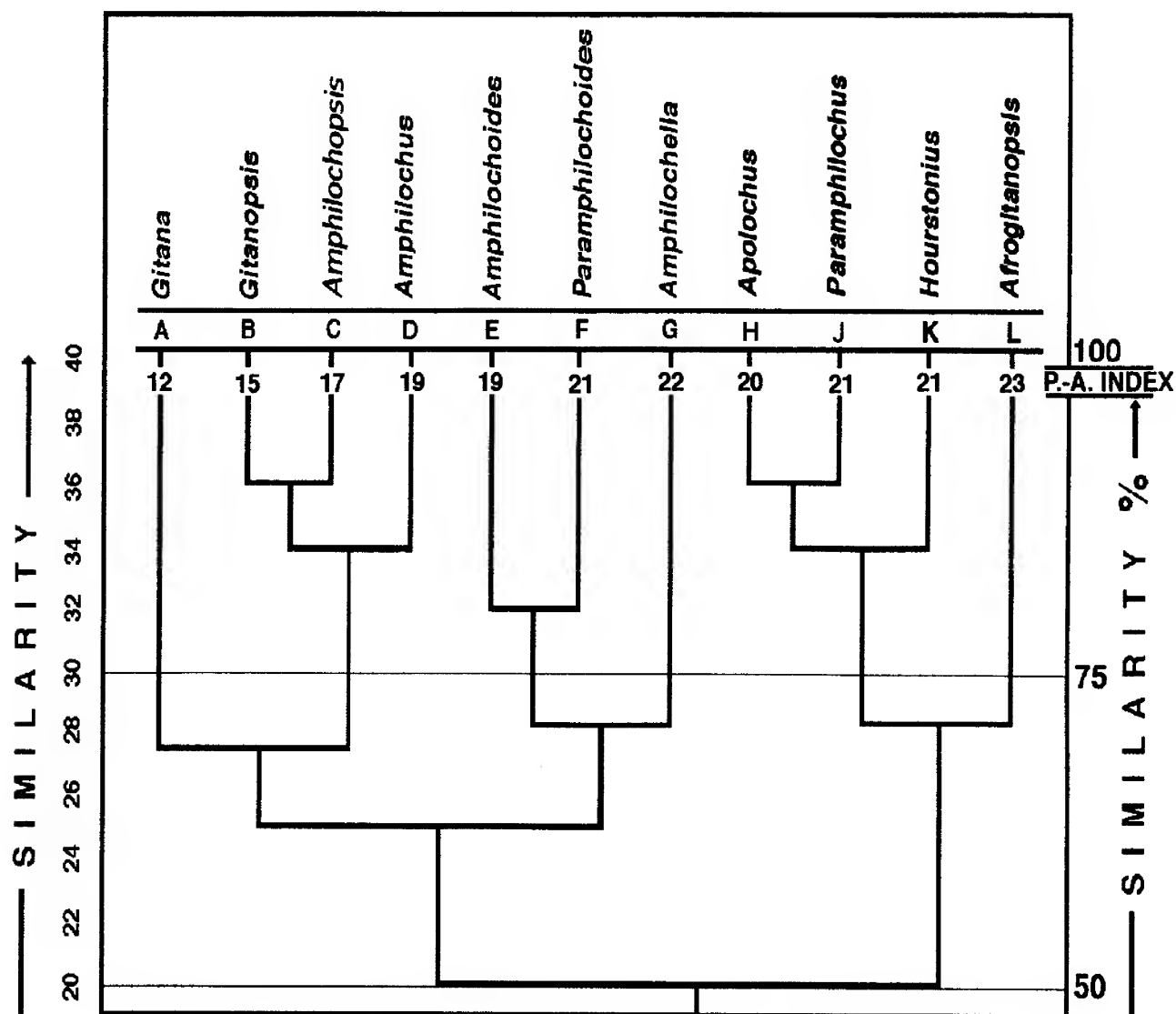


Fig. 10. Phenogram of morphological similarities and possible phyletic relationships within genera of Amphilochoidea.

Species realignment within *Amphilochous* Sars, 1895, and formal recognition of the generic concept *Apolochus* seem clearly in order. Species attributable to genus *Apolochus* exhibit significantly higher A.-P. indices than the three more primitive species here attributed to *Amphilochous* Bate *sens. str.* However, further study, especially of Indo-Pacific regional taxa, is much needed.

Fig. 10 is a phenogram of morphological similarities within genera of family Amphilochoidea, mainly of the northern hemisphere. The genera form three main subgroups at, or slightly below, the 75% similarity level: (1) an Arctic-North Atlantic complex of the primitive genus *Gitana* and the closely related *Gitanopsis*, *Amphilochoopsis* and *Amphilochous*, having low P.-A. values ranging from 12 to 19; (2) a Mediterranean-Indian oceanic complex of advanced genera

Amphilochooides, *Paramphilochooides* and *Amphilochella*, with intermediate P.-A. values of 19-21; and (3) a moderately advanced group of the closely related genera *Hourstonius* and *Apolochus* "satellite genera" *Paramphilochous* and *Afrogitanopsis* respectively, all with intermediate to high P.-A. values of 20-23. The two principal genera encompass about half the known species within the entire family.

The analysis further tends to confirm generic realignment of species within the new generic concepts of *Hourstonius* and *Apolochus*. The overall morphological closeness of these two genera underscores a need for use of multiple-character analysis, and avoidance of single- or few-character diagnoses, in defining taxonomic concepts at generic level and higher.

Phyletic and Biogeographic Conclusions

Members of family Amphilochidae are ectocommensals on gorgonians, hydroids and other sessile marine invertebrates. Their overall body and limb morphology is relatively primitive, in many ways similar to that of leucothoidean family Pleustidae. Such is expressed in the distinct rostrum, deep coxal plates, homopodous peraeopods, posterolobate coxae, and lanceolate uropod rami. However, morphological specializations including near-total loss of an accessory flagellum, modification of mouthparts for carnivory, and development of strongly subchelate gnathopods, are considered apomorphic.

Members of the primitive genus *Gitana* are mainly arctic-boreal and deep water, those of the more advanced genera *Gitanopsis* (*sens. str.*), *Amphilochopsis*, and *Amphilochus* (*sens. str.*) are arctic-boreal and temperate, whereas those of the most advanced genera *Hourstonius*, *Apolochus* and *Paramphilochus* exhibit temperate, warm-temperate distributions in the northern hemisphere. These trends somewhat reflect the significance of higher phyletic classification in biogeographical relationships of North American marine amphipod taxa (Bousfield 2001). In this scenario, the most primitive higher taxa tend to occur mainly in Arctic waters, secondarily along the Pacific coast, and the most advanced taxa in the North Atlantic and Gulf regions. This phenomenon may reflect two major long-term evolutionary factors. Firstly, morphological evolution proceeds at a higher rate at higher ambient temperatures, and conversely at a lower rate at lower temperatures. Secondly, it may also reflect the long-term stability of a given marine region over geological time, wherein faunas of the ancient Pacific coast prove to be more primitive than those of the relatively recently developed North Atlantic Basin. As a corollary, the presence of ancient and relict coastal marine faunas within a higher taxon are more likely to be found in cold-temperate and Arctic regions, especially of long-term geological age. Conversely most highly advanced faunas are likely to be found in warm temperate and tropical regions, especially those of relatively recent geological origin.

REFERENCES

- Austin, W. C. 1985. Amphipoda. In: An annotated checklist of marine invertebrates in the cold temperate Northeast Pacific. *Khoyatan Marine Lab* 3: 588-623.
- Barnard, J. L. 1962. Benthic Marine Amphipoda of southern California: families Amphilochidae, Leucothoidae, Stenothoidae, Argissidae, Hyalidae. *Pacific Naturalist* 3: 116-163, 23 figs.
- Barnard, J. L. 1964. Marine Amphipoda of Bahia de San Quintin, Baja California. *Pacific Nat.* 4(3): 55-139, 21 figs., maps.
- Barnard, J. L. 1966. Benthic Amphipoda of Monterey Bay. *Proc. U. S. Nat'l Mus.* 119 (3541):1-41.
- Barnard, J. L. 1969a. The families and genera of marine gammaridean Amphipoda. *Bull. U. S. Nat'l Mus.* 271: 1-535, 173 figs.
- Barnard, J. L. 1969b. Gammaridean Amphipoda of the rocky intertidal of California: Monterey Bay to La Jolla. *Bull. U. S. Nat'l Mus.* 258: 1-230, 65 f.
- Barnard, J. L. 1970. Sublittoral Gammaridea (Amphipoda) of the Hawaiian Islands. *Smiths. Contr. Zool.* 34: 1-286. 180 figs.
- Barnard, J. L. 1975. Amphipoda: Gammaridea. pp. 313-366, pls. 70-85. In R. I. Smith & J. T. Carlton (eds). *Light's Manual: Intertidal Invertebrates of the Central California Coast*, 3rd ed. Univ. California Press: 716 pp.
- Barnard, J. L. 1979. Littoral gammaridean Amphipoda from the Gulf of California and the Galapagos Islands. *Smiths. Contr. Zool.* 271: 149 pp., 74 figs.
- Barnard, J. L., & G. S. Karaman 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). Part 2. *Rec. Australian Mus. Suppl.* 13 (Parts 1 & 2): 866 pp., 133 fig.
- Barnard, J. L., & J. D. Thomas 1983. A new species of *Amphilochus* from the gorgonian *Pterogorgia anceps* in the Caribbean Sea. pp. 179-18, 3 figs. In P. A. John (ed.). *Selected Papers on Crustacea. Trivandrum: The Aquarium.*
- Barnard, K. H. 1916. Contributions to the crustacean fauna of South Africa. 5. The Amphipoda. *Ann. S. Afr. Mus.* 5: 105-302, pls. 26-28.
- Bate, C. S. 1862. Catalogue of the specimens of amphipodous Crustacea in the collections of the British Museum, iv + 399, pls. 1, 1A: 2-58, British Museum Nat. Hist., London.
- Bellan-Santini, D., & M. Ledoyer 1974. Gammariens (Crustacea - Amphipoda) des Iles Kerguelen et Crozet. *Tethys* 5 (4): 635-708.
- Boeck, A. 1871. Crustacea Amphipodefauna Borealia et Arctica. *Forh. Vidensk.-Selsk Christiana* 1871: 83-280.
- Bousfield, E. L., 1958. Ecological Investigations on shore invertebrates of the Pacific coast of Canada. *Nat'l Mus. Can. Bull.* 147: 104-115.
- Bousfield, E. L., 1963. Investigations on sea-shore invertebrates of the Pacific coast of Canada, 1957

- and 1959. I. Station List. Nat'l Mus. Can. Bull. **185**: 72-89.
- Bousfield, E. L., 1968. Studies on littoral marine invertebrates of the Pacific coast of Canada, 1964. I. Station List. Nat'l. Mus. Can. Bull. **223**: 49-57.
- Bousfield, E. L., 1979. A revised classification and phylogeny of the amphipod Crustacea. Trans. Roy. Soc. Canada, **4** (14): 343-390.
- Bousfield, E. L., 1982. Amphipoda: Gammaridea. pp. 254-285. in Synopsis and Classification of Living Organisms. S. B. Parker (ed.). McGraw-Hill, New York, Vol. II.: 254-285; 293-294.
- Bousfield, E. L. 1983. An updated phyletic classification and palaeohistory of the Amphipoda. Crustacean Issues. A. A. Balkema, Rotterdam. **1**: 257-278.
- Bousfield, E. L. (2000) 2001a. Biogeographical analysis of gammaridean amphipod faunas based on their phyletic classification. Arch. Polske Hydrobiol. **47** (3-4): 335-352..
- Bousfield, E. L. 2001b. An updated commentary on phyletic classification of Amphipod Crustaceans and its applicability to the North American fauna. Amphipacifica **3** (1): 49-120, 8 figs..
- Bousfield, E. L., & A. Chevrier 1996. The amphipod family Oedicerotidae on the Pacific coast of North America. Part I. The *Monoculodes* and *Synchelidium* generic complexes: Systematics and distributional ecology. Amphipacifica **2** (2): 75-148, 42 f.
- Bousfield, E. L. & N. E. Jarrett 1981. Station lists of marine biological expeditions of the National Museum of Natural Sciences in the North American Pacific coastal region, 1966 to 1980. Syllogeus **34**: 1-66, 13 figs.
- Bousfield, E. L., & D. E. McAllister 1962. Station list of the National Museum marine biological expedition to southeastern Alaska and Prince William Sound. Nat'l Mus. Canada Bull. **183**: 76-103.
- Bousfield, E. L. & Shih, C.-t. 1994. The phyletic classification of amphipod crustaceans: problems in resolution. Amphipacifica **1** (3): 76-134.
- Brunel, P., L. Bosse, & G. Lamarche 1998. Catalogue of the Marine Invertebrates of the Estuary and Gulf of St. Lawrence (English title). NRC Spec. Publ., Fish. Aquat. Sci., **126**: 405 pp.
- Chevreaux, E., 1888. Sur quelques crustacés amphipodes provenant d'un dragage de *L'Hirondelle* au large de Lorient. Bull. Soc. Zool. France **13**: 4 pp.
- Chevreaux, E., & L. Fage 1925. Amphipodes. Faune de France **9**: 488 pp., 438 figs.
- Della Valle, A. 1893. Gammarini del Golfo di Napoli. Fauna und Flora des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Monographie **20**: 948 pp., atlas of 61 pls.
- Enequist, P. 1950. Studies on the soft-bottom amphipods of the Skagerak. Zool. Bidr. Uppsala **28**: 297-492, 67 figs.
- Gurjanova, E. F. 1951. Bokoplavny moreii SSSR i sopredel'nykh vod (Amphipoda-Gammaridea). Akad. Nauk SSSR, Opred. po Faune SSSR **41**: 1029 pp., 705 figs.
- Hirayama, A. 1983. Taxonomic studies on the shallow-water Gammaridean Amphipoda of West Kyushu, Japan. I. Acanthonotozomatidae, Ampeliscidae, Ampithoidae, Amphilochidae, Anamixidae, Argissidae, Atylidae and Colomastigidae. Publ. Seto Mar. Biol. Lab. **29** (1/3): 1-92, figs. 43-100.
- Ishimaru, S. 1994. A catalogue of gammaridean and ingolfiellidean Amphipoda recorded from the vicinity of Japan. Rept. Sado Mar. Biol. Sta. **24**: 1-86.
- Ishimaru S., & K. Ikehara 1986. A new genus and species of the subfamily Amphilochinae (Amphipoda: Gammaridea: Amphilochidae) found in the Japan Sea. Zool. Sci. **3** (1): 193-197, 3 figs.
- Jarrett, N., & E. L. Bousfield 1994. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalida. Part II. Subfamilies Pontharpiniinae, Partharpiniinae, Brolginae, Phoxocephalinae, and Harpiniinae: Systematics and Distributional ecology. Amphipacifica **1** (2): 71-150.
- Just, J. 1980. Amphipoda (Crustacea) of the Thule area, northwest Greenland: faunistics and taxonomy. Greenland Bioscience **2**: 1-61, 58 figs.
- Karaman, G. 1980. Revision of the genus *Gitanopsis* Sars with description of new genera: *Afrogitanopsis* and *Rostrogitanopsis* n. g. (fam. Amphilochidae). Polj. I Sumarstvo. Titograd **26**: 43-69, 4 figs.
- Krapp-Schickel, T. 1982. Amphilochidae. in S. Ruffo (ed). The Amphipoda of the Mediterranean. Part I. Gammaridea (Acanthonotozomatidae to Gammaridae). Mem. Inst. Oceanograph. **13**: 70-93, 16 figs.
- Ledoyer, M. 1977. Contribution à l'étude de la faune vagile profonde de la Méditerranée nord occidentale. 1, les gammariens (Crustacea, Amphipoda). Boll. Mus. Civ. Stor. Nat., Verona **4**: 321-421, 32 figs, 2 maps.
- Ledoyer, M. 1978. Amphipodes gammariens (Crustacea) des biotopes cavitaires organogènes récifaux de l'île Maurice (Océan Indien). Maritimus Inst. Bull. **8** (3): 197-332, 43 figs.
- Ledoyer, M. 1979. Expedition Rumphius II (1975)

- crustaceans parasites, commensaux, etc. (Th. Monod et R. Serene, ed.). Crustaceans amphipodes gammariens. Bull. Mus. Nat'l Hist. Nat. Paris 4 (1): 137-181, 19 figs.
- Lincoln, R. J. 1979. British Marine Amphipoda: Gammaridea: 658 pp, 280 figs., 3 pls. British Museum (Natural History), London.
- Lowry, J. K., & A. A. Myers 2000. A family level phylogeny of iphimedioid amphipods (Crustacea Amphipoda). Proc. 10th Amphipod Colloquium, Heraklion, Crete, April, 2000. Abstract.
- McKinney, L. D. 1978. Amphilochidae (Crustacea: Amphipoda) from the western Gulf of Mexico and Caribbean Sea. Gulf Research Reports 6: 137-143, 4 figs.
- Myers, A., 1974. A new species of commensal amphipod from east Africa, Crustaceana 26: 33-336.
- Myers, A. A. 1985. Shallow-water, coral reef, and mangrove Amphipoda (Gammaridea) of Fiji. Rec. Australian Mus. suppl. 5: 144 pp., 109 figs.
- Norman, A. 1869. Shetland final dredging report. Part 2. On the Crustacea, Polyzoa, Echinodermata, Actinozoa, Hydrozoa and Porifera. Rep. Br. Ass. Adv. Sci. 38: 247-336.
- Potts, F. A. 1915. The fauna associated with the crinoids of a tropical reef: with especial reference to its colour variations. Pap. Dept. Mar. Biol. Carnegie Inst., Washington. 8: 71-98, 7 figs.
- Reid, D. M. 1951. Report on the Amphipoda (Gammaridea and Caprellidea) of the coast of tropical West Africa. Atlantide Report 2: 189-291, 58 figs.
- Ricketts, E., & J. Calvin, 1968. Between Pacific Tides. (4th ed.). Stanford University Press: 614 pp.
- Sars, G. O. 1883. Oversigt af Norges Crustaceer med forelobige Bemaerkninger over de nye eller Mindre bekjendte Arter. I. (Podophthalma-Cumacea-Isopoda-Amphipoda). Forh. Vidensk. Christiana 18: 124 pp., 6 pls.
- Sars, G. O. 1895. An Account of the Crustacea of Norway with short descriptions and figures of all the species. Christiania and Copenhagen. Vol 1. Amphipoda. pp. i-viii, 1-711, pls. 1-240, 8 suppl. pls.
- Schellenberg, A., 1926. Die Gammariden der deutschen Sudpolar-Expedition 1901-1903, Deutsch Sudpolar-Expedition 18: 235-414, 68 figs.
- Shoemaker, C. R. 1933. Two new genera and six new species of Amphipoda from Tortugas. Pap. Tortugas Lab. Carnegie Inst., Washington 28 (Publ. 435): 245-256, 8 figs.
- Shoemaker, C. R. 1942. Amphipod crustaceans collected on the presidential cruise of 1938. Smiths. Misc. Coll. 101 (11): 52 pp., 17 figs.
- Shoemaker, C. R. 1955. Amphipoda collected at the Arctic Laboratory, Office of Naval Research, Pt. Barrow, Alaska, by G. E. MacGinitie. Smiths. Misc. Coll. 128 (1): 1-78, 20 figs.
- Sneath, P. H. A., & R. R. Sokal 1973. Numerical Taxonomy. W. H. Freeman & Co., San Francisco. 573 pp.
- Staude, C. P. 1987. Amphipoda Gammaridea. pp. 346-391. In Kozloff, A. (ed.). Marine invertebrates of the Pacific Northwest. Univ. Wash. Press: 511 pp.
- Stebbing, T. R. R. 1876. Amphipodous crustaceans. On the genera Hyale and Anonyx, and a new species of Probolium. Ann. Mag. Nat. Hist. ser. 4, 17: 337-346, pls. 18-19.
- Stebbing, T. R. R. 1888. Report on the Amphipoda collected by H. M. S. Challenger during the years 1873-1876. Report on the scientific results of the voyage of H.M.S. Challenger during the years 1873-1876, Zoology 29: 1737 pp., 210 pls. London.
- Stebbing, T. R. R. 1906. Amphipoda I. Gammaridea. Das Tierreich: 1-806, figs. 1-127.
- Stebbing, T. R. R. 1910. Crustacea. Part V. Amphipoda. Scientific results trawling expedition H.M. C.S. "Thetis". Australian Mus. Mem. 4, 2: 565-658 pls. 47-60.
- Stephensen, K. 1925. Crustacea Malacostraca. VI. (Amphipoda II). Danish Ingolf-Expedition 3: 101-178, figs. 23-53.
- Stimpson, W. 1857. The Crustacea and Echinodermata of the Pacific shores of North America. Jour. Boston Soc. Nat. Hist. 6: 1-92, pls. 18-23.
- Stout, V. R. 1912. Studies in Laguna Amphipoda. First Annual Report of the Laguna Marine Laboratory, pp. 134-149, figs. 74-84.
- Thomas, J. D., & J. L. Barnard 1990. Gitana dominica, a new species from the Caribbean Sea (Amphipoda: Amphilochidae). Proc. Biol. Soc. Wash. 103(3): 617-623.
- Thomson, W. 1880. A new species of Crustacea from New Zealand. Ann. Mag. Nat. Hist. ser. 5, (6): 1-6, pl. 1.
- Yamato, S. 1993. A new amphilochid species (Crustacea: Amphipoda: Amphilochidae) from a spiny lobster. Publ. Seto Mar. Biol. Lab., 36 (1/2): 99-106, 3 figs.

Legend for Figures

A1	-	antenna 1	MD	-	mandible
A2	-	antenna 2	MX1	-	maxilla 1
ACC FL	-	accessory flagellum	MX2	-	maxilla 2
ABD	-	abdomen	MXPD	-	maxilliped
Br PL	-	brood lamella	P5-7	-	peraeopods 5, 6, 7
CX	-	coxal plate	PLP	-	pleopod
EP	-	abd. side plate	RT	-	right
GN1	-	gnathopod 1	SP	-	spine
GN2	-	gnathopod 2	T	-	telson
HD	-	head	U	-	uropod
LFT	-	left	♂	-	male
LL	-	lower lip (labium)	♀	-	female

The Amphipod genus *Anisogammarus* (Gammaroidea: Anisogammaridae) on the Pacific coast of North America.

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ABSTRACT

The genus *Anisogammarus* Derzhavin (sens. lat.) (Amphipoda: Gammaroidea: Anisogammaridae) is represented in the eastern North Pacific coastal marine region by *A. pugettensis pugettensis* (Dana), *A. slatteryi*, n. sp., *A. epistomus*, n. sp., and *A. amchitkana*, n. sp. *Anisogammarus tsvetkovae*, new species, occurs in the northwestern Sea of Japan and Okhotsk Sea, along with the western Pacific subspecies *A. pugettensis dybovskyi* Derzhavin. Anisogammarids are free-living omnivores, occurring in the shallow sublittoral of cold-water, high salinity coastlines. The large coxal gills, each bearing accessory gills, are presumably advantageous for survival in partly anoxic habitats where they commonly occur.

Introduction

The first anisogammarid species was described under the name *Gammarus pugettensis* by J. D. Dana (1853) from material collected in Puget Sound by the U. S. Exploring Expedition. Common regional amphipods described by Stimpson (1857) contained the sole anisogammarid, *Gammarus confervicolus*. Stebbing (1906) summarized records of four Pacific anisogammarid species under various names within *Gammarus* (sens. lat.), mostly within family Gammaridae (sens. lat.). However, Stebbing (loc. cit.) assigned Dana's "*Gammarus pugettensis*", also listed by Holmes (1904), to genus *Liljeborgia*.

During the first half of the 20th century, few anisogammarids were recorded from the North American Pacific coast. Barnard (1954) more fully illustrated Dana's *Anisogammarus pugettensis* based on extensive collections from Oregon, and Shoemaker (1955) described *A. macginitiei* from Pt. Barrow, Alaska. Extensive amphipod material from British Columbia and adjacent regions was collected by National Museum of Canada marine biological expeditions during 1955-1980 (see below). Mainly from this material, the author (1979, 1981) described and illustrated a number of new anisogammarid genera and species. *Anisogammarus macginitiei* was also transferred to the new genus *Barrowgammarus* where is used as an outgroup in later analysis (p. 45). Some of these, and earlier records, are embodied in the general faunistic guides and catalogues of Ricketts & Calvin (1968), Barnard (1975), Austin (1985), and Staude (1987).

Gurjanova (1951) summarized early work on western Pacific anisogammarids, updated by the comprehensive study of Tsvetkova (1975) and the world-wide compilation of Barnard & Barnard (1983). Ishimaru (1994) summarized earlier records from Japan.

The present study attempts to provide a more complete analysis of the systematics and distributional ecology of North American Pacific species of *Anisogammarus*.

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The original taxonomic work was performed as a staff member of the National Museum of Natural Sciences at the Holly Lane Laboratory, Ottawa, ON, 1979-1983. Original line illustrations were prepared with the capable assistance of artist Floy E. Zittin, Cupertino, CA.

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SYSTEMATICS

Anisogammaridae Bousfield

Anisogammaridae Bousfield 1977: 295;—Bousfield 1979: 307 (+key to genera);—1981: 72-76, figs. 1-4;—: 259;—1983: 267;—Barnard & Karaman 1991: 114;—Ishimaru 1994: 46;—Bousfield & Shih 1994: 129.
Anisogammarids: Barnard & Barnard 1983: 582 (+key to genera).
Gammaridae (part): Stebbing 1906: 364;—Gurjanova 1951: 760;—Barnard, 1969 (part): 242;—Tzvetkova 1975 (part): 30.

Type Genus: *Anisogammarus* Derzhavin, 1927: 8.

Genera: *Barrowgammarus* Bousfield, 1979: 321; *Eogammarus* Birstein, 1933: 149; *Spinulogammarus* Tzvetkova, 1972: 954; *Spasskogammarus* Bousfield, 1979: 332; *Locustogammarus* Bousfield, 1979: 322; *Jesogammarus* Bousfield, 1979: 335; *Ramellogammarus* Bousfield, 1979: 337; *Carineogammarus* Bousfield, 1979: 343.

Diagnosis: Head, rostrum very short; inferior antennal sinus large, occasionally with narrow posterior notch. Antennae medium, subequal, accessory flagellum prominent, Antenna 2, peduncle large, flagellum occasionally calceolate.

Mouthparts regular, little modified. Lower lip, inner lobes variously developed. Mandible: left lacinia 5-dentate; spine-row strong.

Peraeon dorsally smooth. Coxal plates 1-4 medium deep, regular; plates 5 & 6 shallowly anterolobate. Gnathopods powerfully subchelate (male); gnathopod 1 larger than 2; palmar margins bearing peg spines (male), simple or pectinate (female); carpus short, lobe small. Peraeopods 5-7, bases weakly heteropodous; dactyls short. Peraeopods 2-7 with large coxal gills, 2-5 with 2, P6 with 3, and P7 with 1-2 accessory gills.

Pleosome and urosome variously dorsally carinate, toothed, spinose, or smooth. Uropods 1 & 2, rami usually short, linear, spinose. Uropod 3 large, subaequiramous, terminal segment small. Telson bilobate, with marginal and apical spines. Female brood plates large, unequal, with numerous long marginal setae.

Remarks: During amplexus, males position themselves dorsally and grasp the anterior margin of coxal plate 4, typically by means of the dactyl and propod of gnathopod 1 (Bousfield & Shih 1994).

Allometric growth changes are often noticeable. Compared with the adult stage, juveniles tend to be armed with fewer but relatively large spines and dorsal tooth of urosome 2, and the inner ramus of uropod 3 is relatively short.

***Anisogammarus* Derzhavin**

Anisogammarus Derzhavin, 1927: 8;—Gurjanova 1951: 776;—Tzvetkova 1975: 94 (part, + key to species);—Barnard & Barnard 1983: 584;—Ishimaru 1994: 46.

Type species: *Gammarus pugettensis* Dana, 1853

Species: *Anisogammarus pugettensis dybovskyi* Derzhavin, 1927; *A. slatteryi* n. sp. (p. 34); *A. epistomus* n. sp. (p. 36); *A. amchitkana*, n. sp. (p. 39); *A. tzvetkova*, n. sp. (p. 41).

Diagnosis: Anterior head lobe acute above, rounded below, with shallow lateral notch. Eye medium, reniform. Antenna 1 shorter than 2; accessory flagellum well developed. Antenna 2, peduncle stout, segment 5 shorter than 4, often with clusters of fine spines with extended tips (male); flagellum lacking calceoli (male).

Mouthparts basic, with few modifications. Lower lip, inner lobes incompletely developed. Mandible: left lacinia 5-dentate; palp slender, terminal segment with well developed "D" spines and "E" setae, but only one cluster of "A" setae (of Cole 1980). Maxilla 1, palp 2-segmented. Maxilla 2, inner plate with full row of oblique facial setae. Maxilliped, inner plate with 3 apical spine teeth; palp setose, not raptorial.

Coxae 1-4 medium deep, smooth, rounded below; coxae 5 & 6 weakly anterolobate. Gnathopod 1 (male) larger than 2 but usually similar in form; in the female it is much larger and of different form than gnathopod 2; carpus short; propodal palm (male) with peg-spines variously developed. Peraeopods 3 and 4, segment 5 short, dactyls short. Peraeopods 5-7, bases broadened proximally, weakly heteropodous; segment 5 longer than 4; peraeopod 7 not longer than 6. Coxal gills on peraeopods 2-5 and 7 each with 2 and on peraeopod 6 with 3, linear accessory gills. Female brood lamellae broad, with numerous long simple marginal setae.

Pleosome smooth above, lacking spines or setae; Epimeral plate 3, hind corner quadrate or slightly produced. Pleopods regular, outer ramus basally with split-tipped "clothespin" spines. Urosome 1 with mid-dorsal hump and 3 groups of spines; uropod 2 with

KEY TO SPECIES OF *ANISOGAMMARUS* AND *BARROWGAMMARUS*

1. Antenna 1 and 2 subequal in length; pereopods 5-7, bases sublinear, not broadened posteriorly; urosome segments 1 & 2 lacking dorso-lateral spines or teeth; uropods 1 & 2, rami lanceolate, unarmed. *Barrowgammarus macginitiei* (p. 44)
- Antenna 1 distinctly shorter than antenna 2; pereopods 5-7, bases broadened proximo-posteriorly; urosome segment 1 with dorsolateral spines; uropods 1 & 2, rami linear, with marginal and apical spines 2.
2. Gnathopod 2 (♂) small, weakly subchelate, as in ♀; uropod 3 (♂, ♀), rami with marginal spines, lacking setae; telson short, length not greater than width *A. amchitkana* (p. 39)
- Gnathopod 2 (♂) large, subsimilar to gnathopod 1; uropod 3, margins of rami with spines and setae; telson normal, length distinctly longer than basal width 3.
3. Gnathopods 1 & 2 (♂), propodal palmar margins with heavy blunt peg spines; mandibular palp elongate; pereopod 4, segment 4 elongate ~2X segment 5 *A. tzvetkovae* (p. 41)
- Gnathopods (♂), spines of palmar margins regular peg spines, tips not broadened; mandibular palp normal; pereopod 4, length of segment 4 ~ 1.5 X segment 5 4.
4. Antenna 1, peduncular segment 2 short, length <1/2 segment 1; epimeral plate 3, hind corner squared or slightly acuminate; urosome 1 with 1-2 weak dorsolateral spines; mandibular palp segment 3 short, "D" spines enlarging distally 5.
- Antenna 1, peduncular segment 2 normal, length >1/2 segment 1; epimeral plate 3, hind corner acute, produced; urosome segment 1 with 3-4 medium strong dorsolateral spines; mandibular palp segment 3 regular, "D" spines of uniform size throughout 6.
5. Coxae 1-3, lower margin richly armed with longish setae; uropod 3 inner ramus markedly shorter than (2/3 length of) outer ramus; telson, distal marginal cluster with one very large, elongate spine (>2X length of other spine) *A. slatteryi* (p. 34)
- Coxae 1-3, lower margin weakly armed with short to medium setae; uropod 3, inner ramus large, length >3/4 outer ramus; telson, distal marginal cluster of spines not markedly unequal in size, (longest <2X other spines). *A. epistomus* (p. 36)
6. Antenna 1 (♂), peduncular segment 5 with scattered clusters of slender, tip-extended spines; uropod 3, outer ramus broad nearly straight *A. pugettensis pugettensis* (p. 31)
- Antenna 1 (♂), peduncular segment 5 with clusters of slender spines in distinct rows; uropod 3, outer ramus slender, medio-distally curved *A. pugettensis dybovskyi* (p. 34)

acute mid-dorsal tooth, and weak postero-lateral cusp on each side. Uropods 1 & 2 short, stout. Uropod 3 subequally biramous, margins spinose and/or plumose-setose; outer ramus with short terminal segment. Lobes of telson each with two groups of lateral spines.

Distribution: Panboreal North Pacific, in algae, mainly on sedimentary bottoms, low intertidal to ~30 m.

Anisogammarus pugettensis pugettensis (Dana)
(Fig. 1)

Gammarus pugettensis Dana, 1853: 957, fig. 1;—Holmes 1904: 239.

Anisogammarus pugettensis Gurjanova 1951(part):777, fig. 541;—Barnard 1954: 13, pls. 12-14;—Tzvetkova 1975(part):98, fig. 35;—Bousfield 1979:310 (key);—Bousfield 1982: 72, fig. 1;—Barnard & Barnard 1983 (part): 584, fig. 38;—Austin 1985: 607;—Stauder 1987: 383.

Material Examined: More than 600 specimens in 99 100 lots.

ALASKA.

SE Alaska, ELB Stns., 1961 (see Bousfield & McAllister, 1962):

A5, Tongass Narrows, near Ketchikan - ♂ (17 mm); lot #2 - ♀ ov (11.5 mm), fig'd specimens, CMNC 1980-0053; A7,

Bostwick Bay, June 2/61 - ♀ (br. II) (14.5 mm), slide mounts, CMNC 1980-0084; Lot # 2 - 2 ♀♀; Lot #3 (18 ♂♂); lot #4 - 5 ♀♀ ov, CMNC 1980-0087; CMNC 1980-0092; CMNC 1980-0094; A11 (100 ♂♂ & ♀♀ ov, small im); Lot #2 (♀, 1 im); Lot #3 (♂, im); A12 (22 ♂♂, 33 ♀♀ ov, 5 im), Lot #2 - 1 ♀ ov; A18 (1 im); A16 (1 im); A20 (1 ♂, 1 ♀ ov, 2 im); A25 (♀, 2 im); A27 (100 large ♂♂ (to 15.5 mm); A27 (Lot #2 - 12 ♀♀ ov); A30 (4 ♀♀ ov, 4 im); A33 (5 ♀♀ ov, 3 juv); A34 (5 ♂♂, 4 ♀♀ ov, 5 im); A37 (1 ♂); A43 (1 ♀ ov), Lot #2 - 12 ♂♂, 15 ♀♀, 20 im; #3 - 14 ♂♂, 33 ♀♀ ov, 15 im); A48 (1 ♀♀ ov); A54 (1 juv); A55 (1 ♂, 1 ♀, Lot #2 - 12 im); A65 (1 ♂); A67 (1 ♀, 14 juv); A71 (12 ♂♂, 20 ♀♀, 14 im; lot #2 - 30 im); A73 (12 ♂♂, 9 ♀♀ ov, 5 im); Lot #2 (8 ♂♂, 14 ♀♀, 2 im); A81 (10 ♂♂, 7 ♀♀ ov, 30 im); A83 (3 ♂♂, 10 ♀♀ ov, 17 juv); A84 (60 ♂♂, ♀♀ ov large); A86 (1 ♂); A88 (3 ♂♂, 12 ♀♀, 2 im); A93 (24 im); A136 (1 ♂, 13 im); A139 (3 ♂♂ 5 ♀♀, 5 im); A140 (9 ♂♂, 15 ♀♀, 30 im & juv); lot #2 (1 ♀, 3 im); A141 (1 ♂); A153 (1 im); A171 (2 juv); A174 (1 ♂, small); Lot # 2 (25 adult, 17 juv).

ELB Stns., 1980 (see Bousfield & Jarrett 1981): S14L1 (3 imm).

BRITISH COLUMBIA:

Queen Charlotte Islands, ELB Stns., 1957 (see Bousfield 1963):

H5 (6 ♂♂, 8 ♀♀, 12 im); N4 (2 juv).

North Central Coast, ELB Stns., 1964 (see Bousfield 1968):

H5 (1 juv); H13 (1 ♀ ov, 35 im); H16 (2 ♂♂, 3 ♀♀, 12 im); H17 (1 ♀, 12 im); H18 (1 juv); H39 (1 juv); H50 (2 im); H56 (4 ♂♂, 10 ♀♀, 13 juv); Lot #2 (8 im).

Pearl Harbour, nr. Prince Rupert, silty sand, eel grass, LW, D. E. McAllister, June 23/65 - 1 ♂.

Northern Vancouver Island, ELB Stns., 1959 (see Bousfield 1963):

V17 (7 ♂♂, 10 ♀♀ ov, 11 im); V18 (1 ♂, 3 im); V22 (75 spms., mostly large ♀♀ ov); lot #2 (1 ♂, gnathopods dissected); N18 (1 ♂, 4 ♀♀, 17 juv).

Southern Vancouver island, ELB Stns.

1955 (see Bousfield 1958):

F3 (1 im); F4 (♀ ov, 13 im); F6 (1 ♂, 43 ♀♀, 5 im, dried); M2 (1 im); M2 (1 ♂, 2 ♀♀); M5 (29 im & juv); G4 (3 juv); G10 (5 im & juv); G11 (8 im & juv); G15 (1 ♂, 3 ♀♀, 2 im).

1970 (for Stns. of 1970-80, see Bousfield & Jarrett 1981): P717 (sev. im).

1975:

Friday Harbor, May /75 - 2 ♂♂ (20 mm).

1976:

Pacific Environmental Institute, West Vancouver, in halibut tank, June 8 - 1 ♂ (18 mm).

1977:

B2 (3 ♂♂, 7 ♀♀, 5 im); B7a, Willis Beach, Oak Pt., Victoria, May 19 - 18 ♂♂, 30 ♀♀ subad (16 mm), slide mount, CMNC 1980-0029; CMNC 1980-0038; CMNC 1980-0039; E2 (2 ♀♀ ov).

Misc. CMN collections:

Ladysmith Hbr., Vancouver I., B. C., D.B. Quayle coll., June 8/38 - 27 ♂♂, ♀♀ ov (broken specimens); Saturna I., Bruce Bight, B. C., J.F.L. Carl coll., Aug. 26/55 - 2 ♀♀ ov; *Ibid.*, night light over kelp, Aug 24/55 - 1 ♂, 1 ♀, 2 juv;

Porpoise Hbr, B. C., 20 m, M. Waldichuk coll., Sept. 24/64 - 3 ♀♀; *Ibid.*, Sept. 18/62 - 3 ♂♂, 7 ♀♀ ov, 1 im, NMNS Cat. No. 6-90; Nass Hbr., Iceberg Bay, on dead fish in trap, S. Gorham coll., June 20/65 - 7 ♂♂, 4 ♀♀ ov., 2 im

Off Cordova, Orca Inlet, Prince William Sound, SE Alaska, 13 m dredge, K. E. Conlan, Feb. 18/89 - ♂, ♀ mating pair.

WASH.-ORE, USA.

ELB Stns., 1955 (see Bousfield, 1958):

F8, Garrison Bay, San Juan I., 9 ♂♂, 6 ♀♀, 4 im.

ELB Stns., 1966 (see Bousfield & Jarrett, 1981):

W3 (1 ♂, 1 ♀, 10 im); W4 (1 im); W5 (1 juv); W7, Meadow Point, Puget Sound, July 17. - ♂ (14.0 mm); ♀ ov. (11 mm), slide mounts, CMNC 1980-0065; *Ibid.*, Lot # 2 - 20 spms; W10 (4 ♂♂, 7 ♀♀ ov, 5 im); W11 (1 juv); W18 (1 juv); W22 (1 im); W33 (♂, 10 im); W39 (6 juv); *Ibid.* (Lot #2 - 3 ♂♂, 7 ♀♀, 35 im); W44 (3 im); W69 (♀ ov).

Diagnosis Male (16 mm): Anterior head lobe slightly incised. Eye medium, sub-reniform. Antenna 1, peduncular segment 2 medium, length 1/2 peduncle 1; flagellum ~20-segmented, little exceeding peduncle of antenna 2. Antenna 2, peduncular segment 5 = 4, with few clusters of tip-extended slender spines; flagellum 17-segmented, shorter than peduncle.

Mandibular spine row with 8-9 blades; palp relatively short; segment 3 > 2/3 segment 2, "D" spines uniform, extending 2/3 of inner margin; segment 2, beta and gamma setae very short. Maxilla 1, palp little broadening distally. Maxilliped, inner plate apically truncate, outer plate little broadened; palp segment 3 regular, length > 1/2 segment 2.

Gnathopods 1 & 2 stout, dactyls with short unguis; Gnathopod 1, palmar angle with 8-10 inner and outer rows of simple spines. Gnathopod 2, propodal postero-distal angle with inner submarginal row of 6 short simple spines. Peraeopods 3 & 4, segment 6 relatively

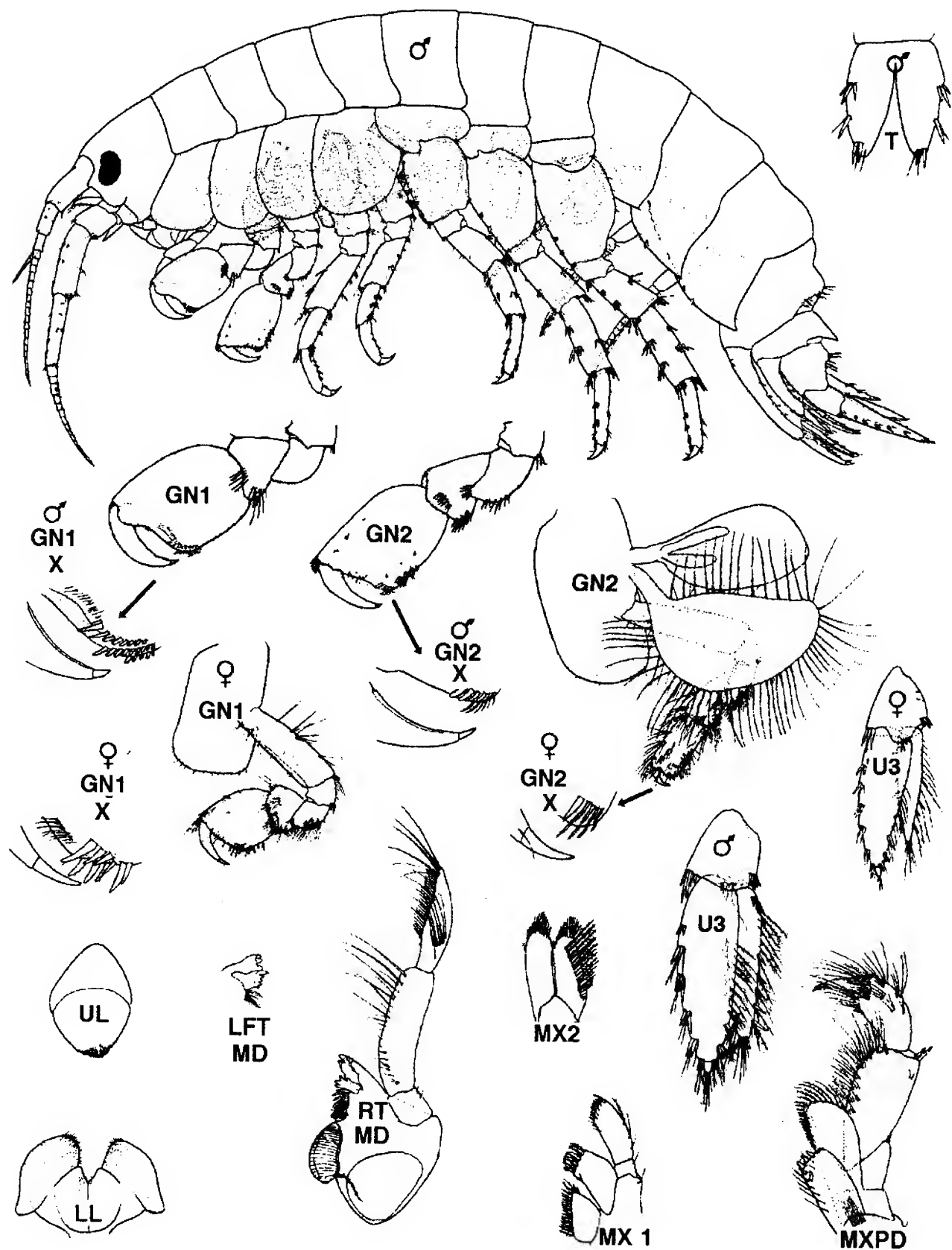


Fig. 1. *Anisogammarus pugettensis pugettensis* (Dana). ♂ (17 mm); ♀ ov. (11.5 mm).
Tongass Narrows, SE Alaska.

short, arched, little longer than segment 5. Peraeopod 7, basis with slight postero-distal marginal excavation. Coxal gill on peraeopod 7 relatively large, broad.

Epimeral plates 2 and 3, hind corner acute, distinctly produced. Urosome 1, mid-dorsal hump medium, with cluster of 8-10 medium spines; lateral clusters with 3-4 spines. Urosome 2 with strong median tooth and single postero-dorsal cusp on each side. Urosome 3 with mid-dorsal and dorsolateral clusters of 2-3 medium spines. Uropods 1 & 2, rami shorter than peduncles, margins moderately spinose. Uropod 3, outer ramus medium broad, inner margin plumose-setose, slightly but distinctly longer than slender inner ramus; terminal segment short.

Telson lobes medium, each side with proximolateral group of three spines, and distolateral longish marginal spine.

Female ov. (14 mm). Gnathopod 1, propod relatively large, subquadrate, posterodistal angle with groups of 3 inner, and 5-6 outer submarginal simple spines. Gnathopod 2, propod subrectangular, postero-distal angle with submarginal row of 1 simple and 4 pectinate spines; brood plate large, broad, with numerous marginal setae. Uropod 3, rami shorter than in male, inner margin plumose-setose.

Distributional Ecology: Aleutian Islands and S. E. Alaska, through B. C. and Washington state south to Coos Bay, Oregon, and Northern California, low intertidal to subtidal, in *Ulva* and *Enteromorpha*, and in partially anoxic bottom deposits of wood chips (Waldichuk & Bousfield 1962).

Remarks: A very similar form has been recorded under this name from the northern Sea of Japan and Sea of Okhotsk by Gurjanova (1951) and Tzvetkova (1975).

Anisogammarus pugettensis (Dana),
subsp. *dybovskyi* Derzhavin
(Fig. 2)

Anisogammarus dybovskyi Derzhavin, 1927: 8;—Stephensen 1944: 47, figs. 10. 11;—Ishimuru 1994 (part): 46.

Gammarus pribiloffensis Pearse, 1913: 571, fig. 1.
Anisogammarus pugettensis Gurjanova 1951 (part): 777, fig. 541;—Tzvetkova 1975 (part): 99, fig. 35;—Ishimaru 1994 (part): 46.

Material Examined:

3 lots from East Kamchatka, USSR, K. Vinogradov coll.,

1933 - ♂ (13 mm), slide mount; 2 ♂♂ (13 mm); ♀ ov. (11 mm), slide mount (identified as *A. pribiloffensis* by E.F. Gurjanova, 1933), Zoological Museum collns., St. Petersburg, Russia.

Alaska-Bering Sea P. Slattery coll:

Mukmuk Bay, St. Lawrence I., 40 ft. scoop, July 1/83 - 3 ♀♀ ov, 3 juv, IZ 1989-002.

NE St. Lawrence I., July/83 - 1 ♂ (18.5 mm).

Unimak I, P. Slattery, June-Oct/82 - 2 ♂♂, 5 ♀♀.

Diagnosis: Male (16 mm). Very similar to *Anisogammarus p. pugettensis* (Dana, 1853) but differing in the following features:

Eye large, reniform. Antenna 2 (male), peduncle 5 subequal to 4, with numerous groups of tip-extended slender spines. Mandibular palp, segment 3 with fewer "A" and "E" setae. Coxa 1 more strongly setose below. Gnathopod 1, propodal palmar spines shorter and thicker, apex more blunt; carpus, posterior lobe narrow, subacute. Peraeopod 7, posterodistal marginal excavation lined with fine setae; segment 6 with a few clusters of longish setae, rather than clusters of short spines. Epimeral plates 2 & 3, hind corner less strongly produced. Coxal gill 7 small and short relative to coxal gill of peraeopod 6. Uropod 3, outer ramus relatively narrow, length 4X width, curved distomedially. Telson lobes each with pair of distolateral short spines.

Distributional Ecology: Western Pacific coastal marine waters, northern Japan Sea and Sea of Okhotsk to western Bering Sea, mostly along open coasts, on sandy and silty substrata, from lower intertidal to depths of 280 m (Tzvetova, 1975); waters around Japan (Ishimaru, 1994); animals scavenge drowned dead human bodies (Kosek et al 1962).

Remarks: This species has been synonymized with *A. pugettensis*, originally described from the eastern Pacific by Dana, 1853. However, sufficient differences exist (above, and key) as to distinguish the two forms at subspecies level.

Anisogammarus slatteryi, n. sp.
(Fig. 3)

Anisogammarus sp. 1, Austin, 1985: 607.

Material Examined:

ALASKA:

St. Lawrence I., Bering Sea, 6 m sand, P. Slattery coll., June 6/87 - 7 juv (2-4 mm); *Ibid.*, lot #2 - 7 juv (2-4 mm). *Ibid.*, Lot #3. - 40 juveniles, CMN collections.

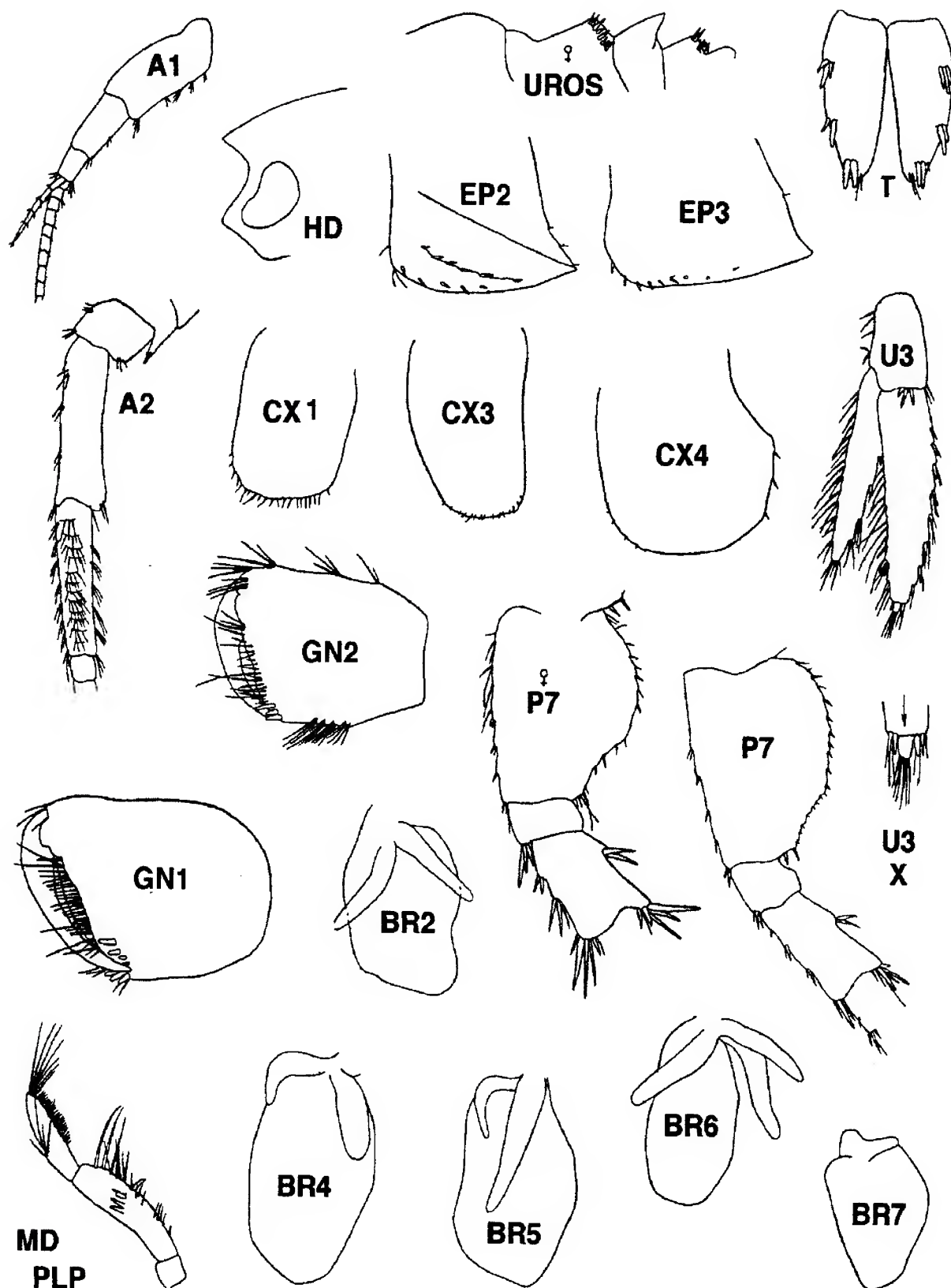


Fig. 2. *Anisogammarus pugettensis dybovskyi* Derzhavin. ♂ (16 mm), Japan Sea; ♀ ov (14 mm). Kurile Islands, Okhotsk Sea. [Modified from Tzvetkova (1975)].

BRITISH COLUMBIA:

ELB Stn. H13, Lulu I., NW end, July 14/64 - ♀ subadult, br. 1 (3.5 mm), CMN coll'ns.

Pachena Bay, Vancouver I., whale pit No. 1, 13 m sand, P. Slattery coll., April 13, 1983 - ♂ (8.0 mm), **Holotype**, (slide mount), CMNC2001-0012; ♀ ov. (6.5 mm), **Allotype**, (slide mount), CMNC 2001-0013; ♂ (8.0 mm), **Paratype**, CMNC 2001-0014; *Ibid*, J. Kendall & P. Slattery coll., Apr. 15/82 - 1 ♀ (5 mm), NMNS Cat. No. 121555.

WASH.-ORE., ELB Stns., 1966:

W46, Leadbetter Point, open sandy beach, LW, Aug. 4, 1966 - 1 ♂ subadult (4.5 mm), CMN coll'ns.

Diagnosis. Male (8.0 mm): Anterior head lobe, frontal margin straight. Eye medium large, subreniform. Antenna 1, peduncular segment 2 very short, length ~1/3 peduncle 1; flagellum ~14-segmented, little exceeding peduncle of antenna 2. Antenna 2, peduncular segment 5 shorter than 4, with scattered clusters of tip-extended slender spines; flagellum 10-12-segmented, shorter than peduncle.

Mandibular spine row with 5 blades; palp relatively short, segment 3 > 2/3 segment 2; segment 3, "D" spines in short row, increasing in length distally. Maxilla 1, palps slightly narrowing distally. Maxilliped, inner plate apically oblique, outer plate little broadened, with long apical pectinate setae; palp segment 3 short, length ~ 1/2 segment 2.

Coxae 2-4, lower margins with 8-10 mainly longish setae. Gnathopod 1 very stout, distinctly larger than gnathopod 2; dactyls with short unguis. Gnathopod 1, palmar angle with inner and outer submarginal rows of 6-7 and 3-4 simple spines respectively. Gnathopod 2, palmar angle with inner submarginal rows of 4 and 2 short simple spines respectively. Peraeopods 3 & 4, segment 6 straight, longer than segment 5. Coxae 3-4 distinctly anterolobate. Peraeopods 5-7, bases distinctly heteropodous; peraeopod 6 slightly the longest. Peraeopods 6 & 7, basis with slight postero-distal marginal excavation. Coxal gill on peraeopod 7 large, about equal in size to that of peraeopod 6.

Epimeral plate 3, hind corner squared. Urosome 1, mid-dorsal hump very low, with 1-2 small spines and weak lateral clusters of 2 spines. Urosome 2 with small median tooth, posterodorsal cusps lacking. Urosome 3 with single mid-dorsal and dorsolateral medium spines. Uropods 1 & 2, rami shorter than peduncles, outer ramus of uropod 2 lacking marginal spines. Uropod 3, outer ramus short, medium broad, margins spinose; terminal segment distinct; inner ramus short, ~ 1/2 outer ramus, inner margin with few plumose setae.

Telson lobes short, each side with proximolateral group of three spines, and distolateral pair of unequal spines.

Female ov. (6.5 mm). Antenna 2, flagellum 10-segmented. Gnathopod 1 medium large, subquadrate, spination of posterodistal angle similar to that of male. Gnathopod 2, propod short, subrectangular, posterodistal angle with inner submarginal row of 3 simple, outer row of 4-5 pectinate spines. Brood plate large, broad, but with relatively few (<30) marginal setae. Uropod 3, rami shorter than in male, margins spinose, with a few simple setae.

Etymology: The name recognizes marine biologist Dr. Peter F. Slattery, who has contributed broadly to knowledge of marine benthic communities on the Pacific coast of North America.

Distribution: Bering Sea south through Vancouver I. to Washington State, LW and subtidally, to depths of ~13 m, on sand and in feeding pits of the gray whale, *Eschrichtius robustus*.

Remarks: The species is very similar to *A. epistomus* but differs mainly in its smaller size, normally unproduced epistome, and other character states of the key (p. 31).

The small subadult female from Lulu I., has markedly unequal rami of uropod 3, and long coxal setae.

Although the small specimen from Leadbetter Pt. was not dissected, it exhibits some characteristics of *A. slatteryi*, including a small mid-dorsal tooth on urosome 2, and relatively large and powerful gnathopods. The inner ramus of uropod 3 is relatively short and thin.

Anisogammarus epistomus, n. sp.

(Figs. 4, 4A)

Anisogammarus sp. 2, Austin, 1985: 607.

Material Examined.**BRITISH COLUMBIA:****Southern Vancouver I., ELB Stns.****1955:**

P6a, Long Beach, SE end Wickaninnish Bay, under algal debris on sand, LW, Aug. 2 - ♂ (13.0 mm), **Allotype**, (slide mount), CMNC 2001-0010; 1 ♂ subadult (10.0 mm), **Paratype**, CMNC 2001-0011.

1970:

P710b, Cape Beale (48° 47.2'N, 125° 13'W), sand, algae, and bedrock, LW level, July 19 - ♀ ov. (13.0 mm), **Holotype**, (slide mount). Fig'd type specimen, and slide mount, could not be located in CMN collections at time of writing).

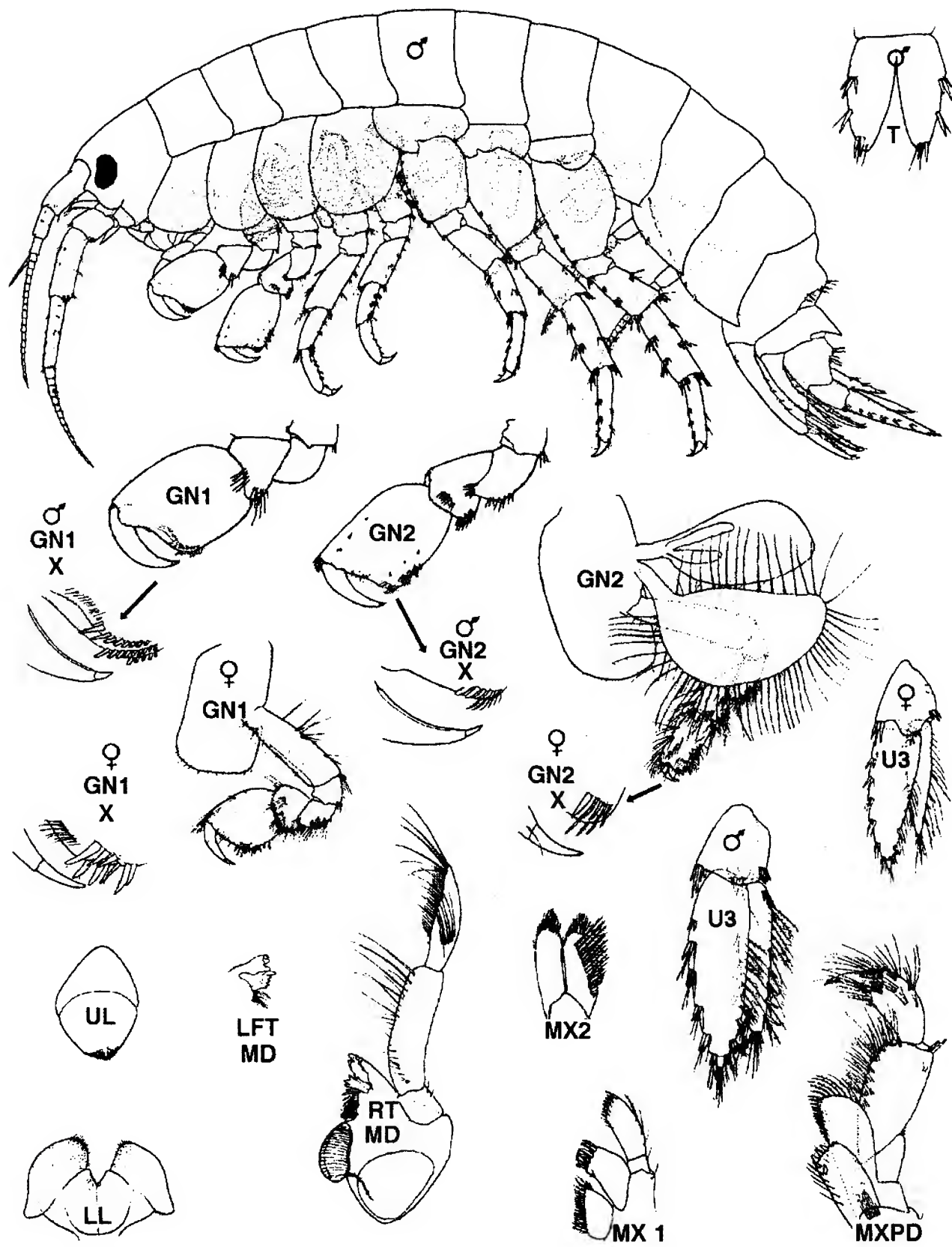


Fig. 3. *Anisogammarus slatteryi*, n. sp. Male (8.0 mm), Holotype; ♀ ov (6.5 mm), Allotype. Pachena Bay, Vancouver I, B.C.

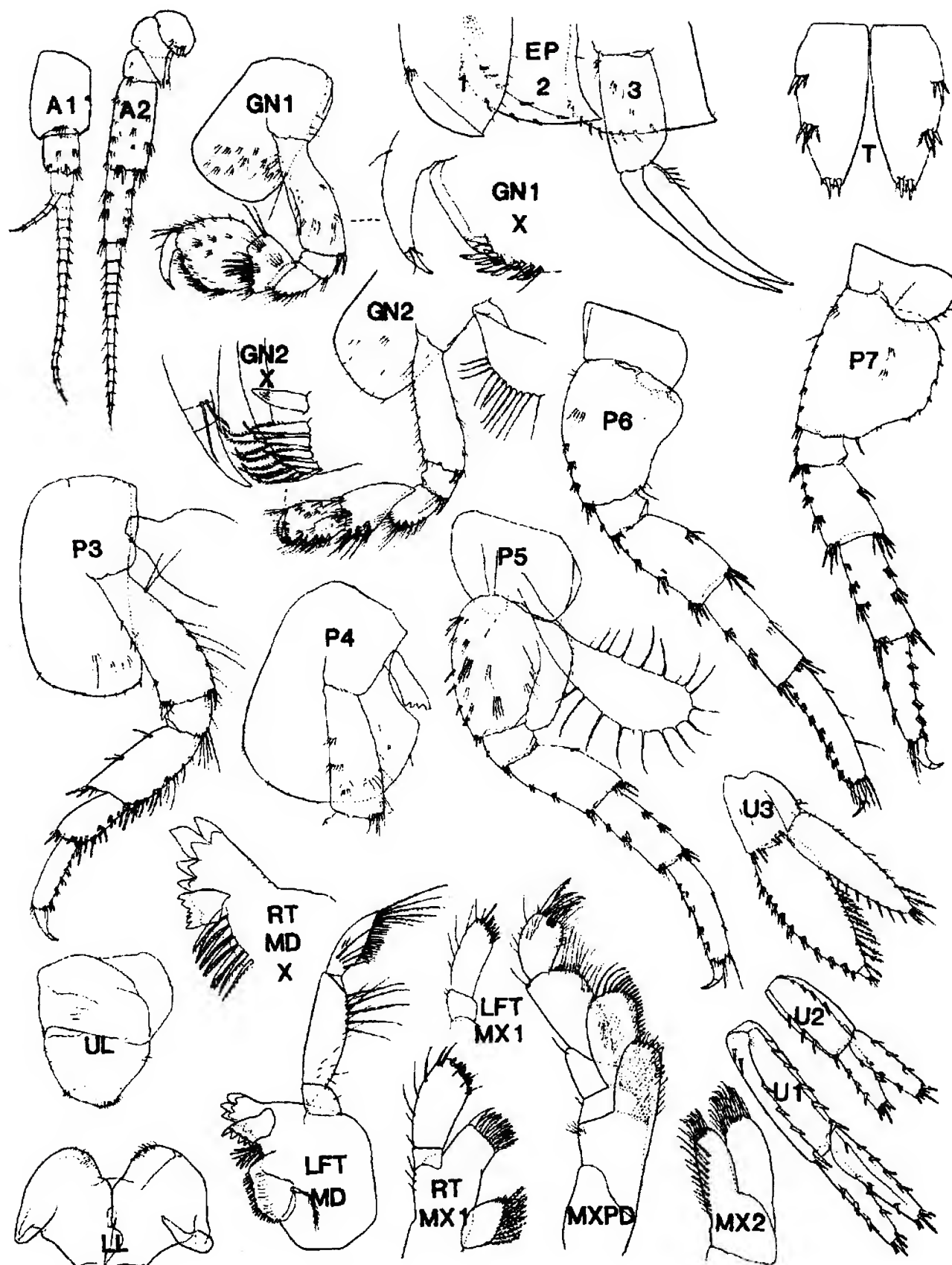


Fig. 4. *Anisogammarus epistomus* n. sp. ♀ ov (13 mm), Holotype. Cape Beale, Vancouver I., B.C.

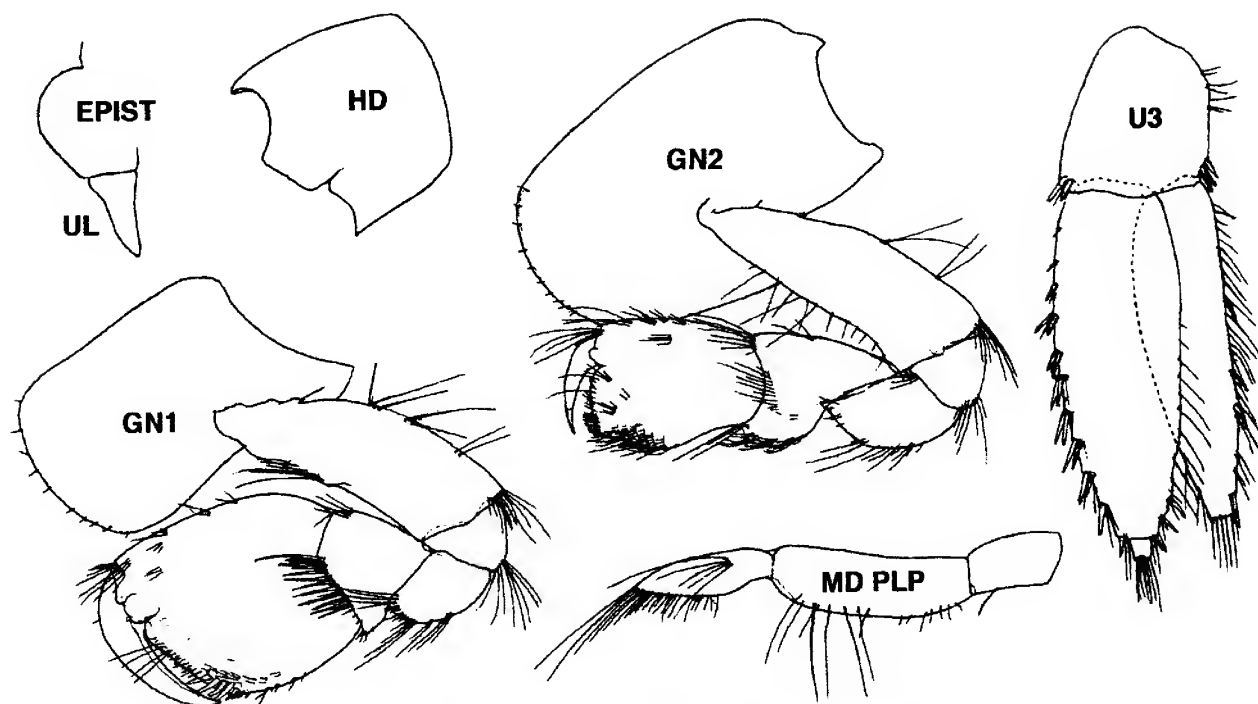


Fig. 4A. *Anisogammarus epistomus* n. sp. ♂ (13.0 mm), Allotype. Long Beach, V. I., B. C.

Diagnosis. Female ov (13.0 mm), Holotype: Anterior head lobe not incised; inferior antennal sinus shallow, posterior "notch" at right angles to it. Eye medium subreniform. Antenna 1, peduncular segment 2 short, $\sim 1/3$ peduncle 1; flagellum ~ 16 -segmented, distinctly exceeding peduncle of antenna 2. Antenna 2, peduncular segment 5 shorter than 4, surfaces with a few clusters of short spines; flagellum 15-segmented, shorter than peduncle.

Mandibular spine row with 7 blades; palp relatively short, segment 3 $< 1/2$ segment 2, "D" spines extending $2/3$ of inner margin. Maxilla 1, right palp slightly broadening distally. Maxilliped, inner plate apically subtruncate, outer plate slightly broadened; palp segment 3 medium, length $> 1/2$ segment 2.

Gnathopods 1 & 2 large, strong; dactyls with short unguis. Gnathopod 1, palmar angle with 8-10 inner and outer rows of simple spines. Gnathopod 2, propodal postero-distal angle with inner submarginal row of 6 short simple spines. Peraeopods 3 & 4, segment 6 relatively short, arched, little longer than segment 5. Peraeopod 7, basis with slight post-erodistal marginal excavation. Coxal gill on peraeopod 7 relatively large, broad.

Epimeral plates 2 and 3, hind corner acute, slightly produced. Urosome 1, mid-dorsal hump medium, with cluster of 8-10 medium spines; lateral clusters with 3-4 spines. Urosome 2, with strong median tooth and single postero-dorsal cusps on each side. Urosome 3, with mid-dorsal and dorsolateral clusters of 2-3 me-

dium spines. Uropods 1 & 2, rami shorter than peduncles, margins moderately spinose. Uropod 3, outer ramus medium broad, inner margin plumose-setose, slightly but distinctly longer than slender inner ramus; terminal segment short.

Telson lobes medium, each side with proximolateral group of three spines, and distolateral longish marginal spine.

Male (13.0 mm), Allotype: Antenna 1 elongate, flagellum of 22 segments; accessory flagellum 6-segmented. Antenna 2, peduncular segment 5 with few surface clusters of slender spines.

Upper lip, epistome prominently bulging anteriorly. Mandibular palp with 5 "A" setae.

Coxae 2-4, lower margins nearly bare, armed sparsely with short setae. Gnathopod 1, propod and dactyl powerful, propodal palmar spines regular, tips little or not broadened. Gnathopod 2, propod much less powerful, similar in form and armature to that of female but slightly more powerful.

Peraeopod 5, basis very broad, hind margin rounded. Uropod 3, rami subequal in length; outer ramus with 9-11 groups of spines, inner margin distally plumose-setose; inner ramus, inner margin with spines and setae; terminal segment very short.

Telson, lobes normal, longer than basal width.

Etymology: From "epi" + "stomum", alluding to the large epistome protruding over the upper lip.

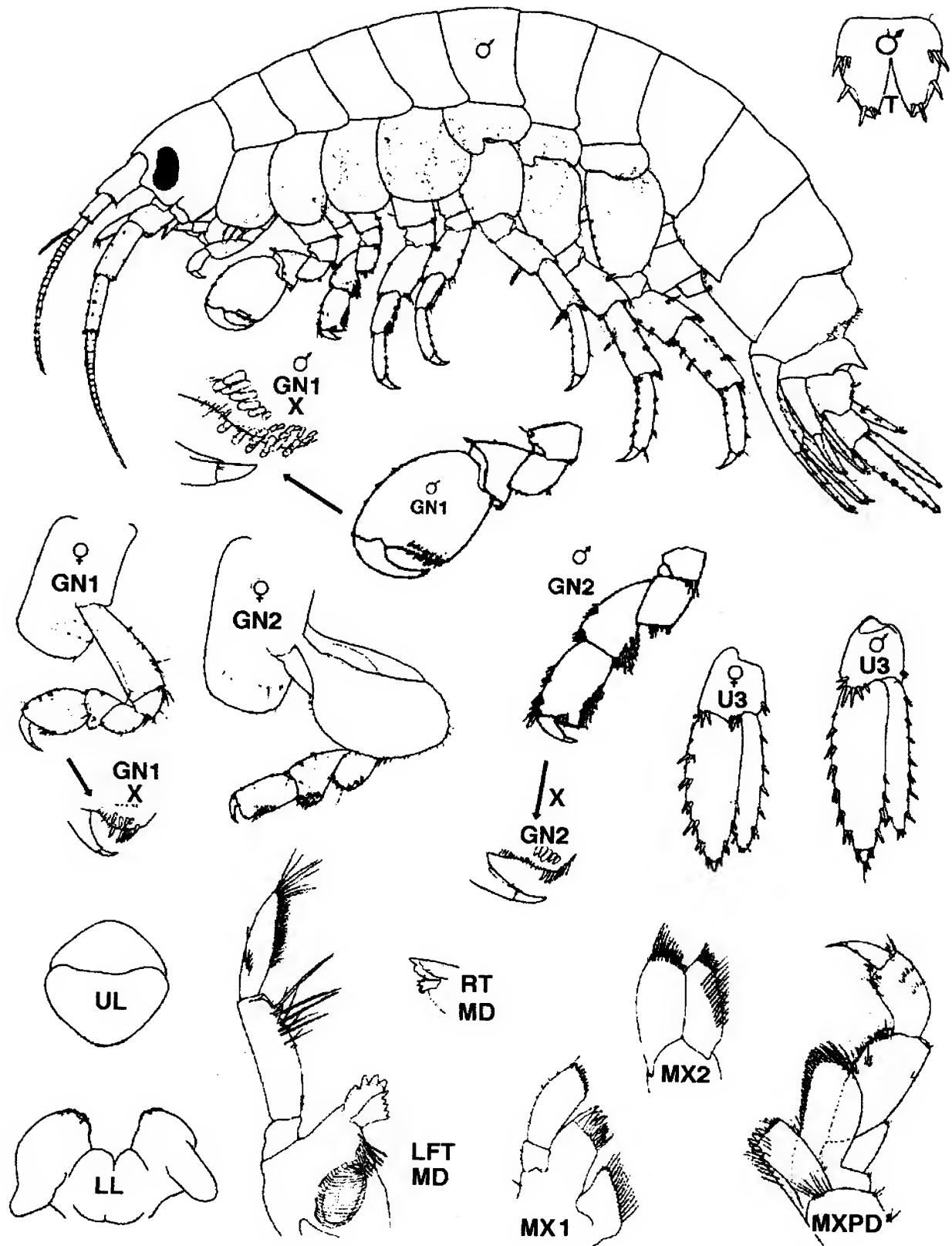


Fig. 5. *Anisogammarus amchitkana* n. sp. ♂ (15 mm), Holotype; ♀ ov (14.0 mm), Allotype. Cyril Cove, Amchitka, Alaska.

Distributional Ecology: Known only from the outer coast of Vancouver Island, from Pachena Bay to Wickaninnish Beach; under algal debris, on open surf-exposed sand, LW level, probably shallow subtidal.

Remarks: Character states of *Anisogammarus epistomus*, especially of the male, suggest that the species is a member of the *pugetensis* group, with weakly developed palmar peg spines, but closer to *A. amchitkana*, having weakly developed gnathopod 2 and large aequiramus uropod 3.

Anisogammarus amchitkana, n. sp.
(Fig. 5)

Material Examined.

Bering Sea-Alaska region:

Lot #1, Square Bay, Cyril Cove, Amchitka, Aleutian Islands, C. E. O' Clair coll., Mar. 24, 1969 - ♂ (15 mm), **Holotype**, slide mount, CMNC2001-0015; 1 ♀ ov, **Allotype** (14 mm), slide mount, CMNC2001-0016; 5 ♀♀ ov, **Paratypes** (1 ♀ ov, dissected), CMN collns.

Constantine Harbor, Amchitka I., among algae on dock pilings, P. Slattery coll., Sept. 7, 1969 - 1 ♂ (12 mm), CMN Acc. No. 1982-79.

St. Lawrence I., SE Cape, in kelp & mysid swarms, P. Slattery coll., June 6/86 - 54 subadult specimens (3-5 mm), CMN collns.

Kialegak camp, SW St. Lawrence Bay, Aug. 25, 1985 - 1 ♀ br. II (11 mm) + 4 ♀♀ im (8-10 mm), CMN collns.

Diagnosis. Male (15 mm): Anterior head lobe distinctly incised. Eye medium large, subreniform. Antenna 1, peduncular segment 2 medium, length $> 1/2$ peduncle 1; flagellum ~20-24-segmented, little exceeding peduncle of antenna 2. Antenna 2, peduncular segment 5 = 4, with few clusters of tip-extended slender spines; flagellum ~20-segmented, nearly as long as peduncle.

Mandibular spine row with 7 blades; palp short, segment 3 $> 2/3$ segment 2. Maxilla 1, palp slightly broadening distally. Maxilliped, inner plate apically truncate, outer plate slightly broadened; palp segment 3 regular, length $> 1/2$ segment 2.

Coxae 1-4 medium deep, lower margins rounded, weakly setulose. Gnathopods 1 & 2 very unequal in size; gnathopod 1 large, powerfully subchelate, gnathopod 2 weakly subchelate, as in female; dactyls with short unguis. Gnathopod 1, palmar angle with inner and outer rows of 8-12 mostly peg spines, inner row extending well up palm. Gnathopod 2, propodal subrectangular, posterodistal angle with inner and outer submarginal rows of 5 and 6 short simple spines,

respectively. Peraeopods 3 & 4, segment 6 relatively short, arched, little longer than segment 5. Coxae 5 & 6 shallowly anterolobate. Peraeopods 5-7, bases weakly heteropodous. Peraeopod 7, basis relatively narrow, posterodistal margin straight. Coxal gill on peraeopod 7 small, narrow relative to gill on peraeopod 6.

Epimeral plates 2 and 3, hind corners weakly acute. Urosome 1, mid-dorsal hump low, with cluster of 8-10 medium spines; lateral clusters each with 3-4 spines. Urosome 2 with ordinary median tooth and single posterodorsal cusps on each side. Urosome 3 with mid-dorsal and dorsolateral clusters of 2-3 medium spines. Uropods 1 & 2, rami subequal in length to peduncles, margins moderately spinose. Uropod 3, outer ramus medium broad, margins with 6-7 clusters of short spines, distinctly longer than slender spinose inner ramus; terminal segment short.

Telson lobes short, basally broad, each side with proximolateral group of three spines, and distolateral single short marginal spine.

Female ov (14 mm). Gnathopod 1, propod relatively small, subovate, posterodistal angle with groups of 5 inner, and 4 outer submarginal simple spines. Gnathopod 2, propod subrectangular, posterodistal angle with submarginal row of 1 simple and 4 pectinate spines; brood plate large, broad, with numerous marginal setae. Uropod 3, rami shorter and broader than in male, margins spinose.

Etymology: The species name acknowledges the type locality on the Aleutian Island of Amchitka.

Distributional Ecology: Amchitka and Aleutian Islands, from LW intertidal to depths of ~10 m.

Remarks: The small body size, relatively large size of both gnathopods 1 & 2 (male), and presence of more strongly developed propodal palmar peg spines remove *amchitkana* from the *A. pugetensis* - *slatteryi* complex (see Fig. 8).

Anisogammarus tzvetkova, n. sp.
(Fig. 6)

Anisogammarus possjeticus Tzvetkova, 1975 (part?).

Material Examined: Peter-the-Great Bay, Russia, LW intertidal, Nina L. Tzvetkova coll. - ♂ (24.5 mm), **Holotype**; ♀ ov. (18.0 mm), **Allotype**; slide mounts, loan material, Zoological Institute, St. Petersburg, Russia.

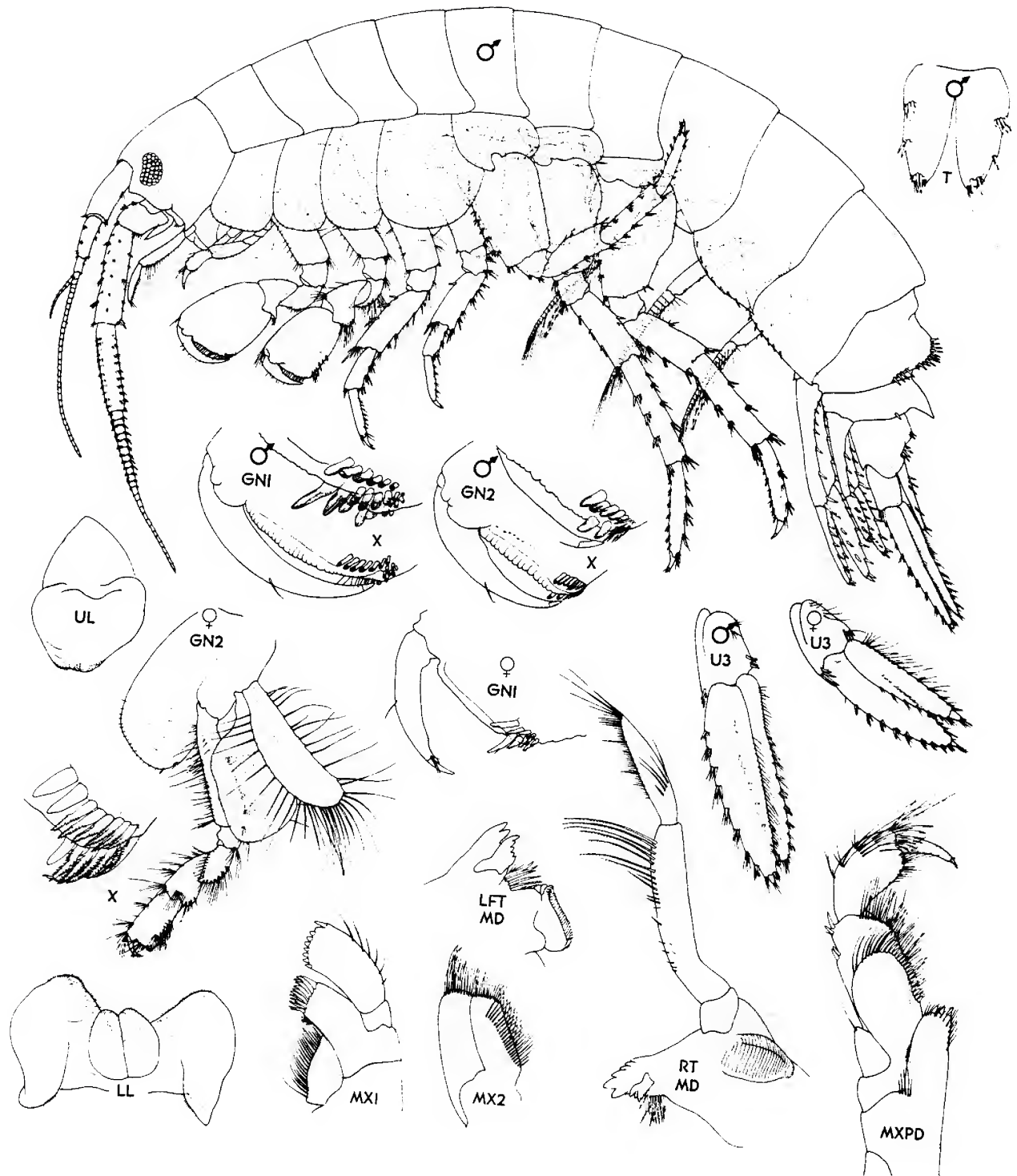


Fig. 6. *Anisogammarus tzvetkovae*, n. sp. ♂ (24.5 mm), Holotype; ♀ ov (18 mm) Allotype. Peter-the-Great Bay, Sea of Japan.

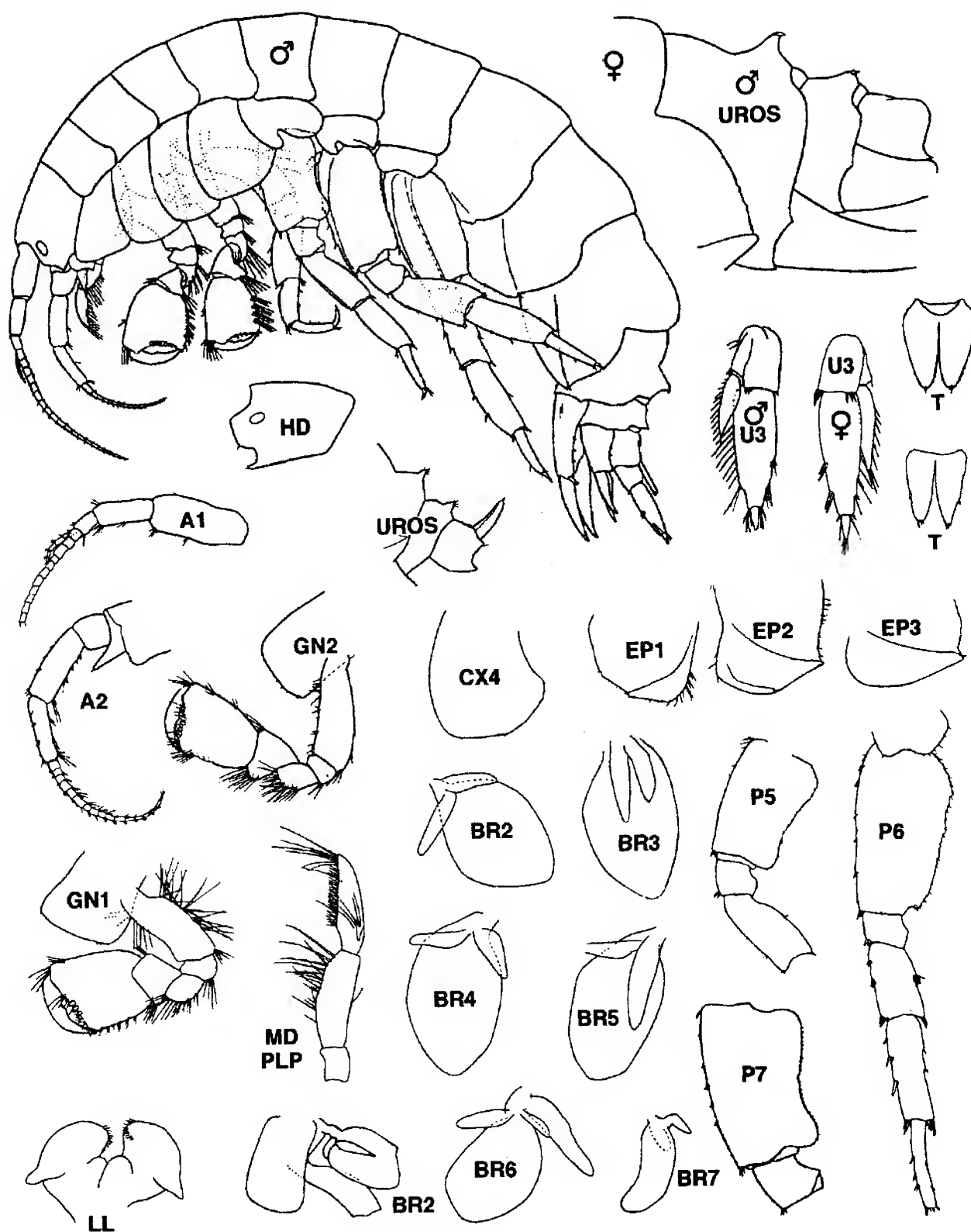


Fig. 7. *Barrowgammarus macginitiei* (Shoemaker, 1955). ♂ (37 mm). Point Barrow, Alaska. [after Shoemaker (1955) and Tzvetkova (1975)].

Diagnosis: Male (24.5 mm). Anterior head lobe slightly incised. Eye smallish, subreniform. Antenna 1, peduncular segment 2 medium long, 2/3 length of peduncle 1; flagellum elongate, ~30-segmented, exceeding peduncle of antenna 2. Antenna 2 large, peduncular segment 5 nearly equal in length to 4, with numerous anterior and posterior marginal clusters of slender spines with extended tips, continuing onto proximal flagellar segments; flagellum of 20+ segments, shorter than peduncle.

Mandibular spine row with 6 blades; palp slender, elongate; segment 3 > 1/2 segment 2, "D" spines short, extending proximad of facial cluster of "A" setae; segment 2 with 8-10 long alpha setae. Maxilla 1, palp distinctly broadening distally, apex with 7-8 short spines. Maxilliped, inner plate apically truncate, outer plate tall, broadened; palp segment 3 regular, length ~ 2/3 segment 2.

Coxae 1-4 relatively deep, 1-3 narrow, lower margin with a few short setae. Gnathopods 1 & 2 stout; dactyls with short unguis. Gnathopod 1, palmar margin rugose, file-like, posterior angle with 6-8 inner, medial, and outer rows of stout peg-spines; carpus with short narrow posterior lobe. Gnathopod 2, propodal posterodistal angle with inner and outer submarginal row of 4-6 short peg spines. Peraeopods 3 & 4, segment 4 elongate, segments 5 & 6 relatively short, subequal; dactyls very short. Coxae 5 & 6 shallowly anterolobate. Peraeopods 5-7, bases relatively narrow, little broadened; basis of peraeopod 7 with slight posterodistal marginal excavation. Coxal gill on peraeopod 7 large, broad, deep, nearly as large as gill of peraeopod 6.

Epimeral plates 2 and 3, hind corner minutely acute, lower margins spinose. Urosome 1, mid-dorsal hump large, with mid-dorsal "V" of ~20 stout spines; dorso-lateral clusters each with 3-4 spines. Urosome 2 with strong median tooth and single posterodorsal short spines on each side. Urosome 3 with mid-dorsal and dorso-lateral clusters of 2-4 medium spines. Uropods 1 & 2, rami shorter than peduncles, margins spinose. Uropod 3, rami large, slender, inner slightly the shorter, margins with 8-10 clusters of short spines and setae; terminal segment small.

Telson lobes medium long, narrowing distally, proximolateral and distolateral spines short. Female ov (18 mm). Gnathopod 1, propod medium large, subrectangular, posterodistal angle with groups of 5 inner, and 4 outer submarginal simple spines. Gnathopod 2, propod slender, elongate-rectangular, posterodistal angle with inner submarginal row of 2 simple and 6-7 pectinate spines, and outer submarginal

row of 1 simple spine and 5-6 pectinate spines. Brood plate on peraeopod 2 relatively small and slender, with ~30 longish marginal setae. Uropod 3, rami shorter than in male, and margins less setose.

Etymology: In recognition of Dr. Nina L. Tzvetkova, Zoological Institute, St. Petersburg, Russia, who has contributed in an outstanding manner to knowledge of gammaroideans and littoral marine amphipoda of the northwestern Pacific Ocean.

Distributional Ecology: Known only from the coasts of North and South Korea, the northwestern coast of Japan, and Peter-the-Great Bay, Russia.

Remarks: Material and illustrations from the east coast of South Korea, kindly supplied by Dr. Chang Bae Kim in 1992 (pers. commun.) is virtually identical with that of Dr. Nina Tzvetkova from Peter-the-Great Bay (above).

Barrowgammarus Bousfield

Barrowgammarus Bousfield, 1979: 321;—Barnard & Barnard 1983: 586.

Diagnosis: Body very large. Eyes small, oval. Antennae subequal in length, sparsely setose, not calceolate. Mouthparts poorly described. Mandibular palp, segment 3 slender, "D" setae uniformly short, extending proximally to distal group of "A" setae.

Gnathopods powerfully subchelate, propodal palmar margins with peg spines (male). Peraeopods 5-7, bases little expanded, each with distinct posterodistal lobes; dactyls short. Coxal gills 2-5 with paired accessory gills; coxal gills 6 & 7 with single accessory gills.

Pleon smooth above. Urosome segments 1 and 2 each with prominent mid-dorsal tooth. Uropods 1 & 2, rami lanceolate, lacking marginal spines. Uropod 3, inner ramus short, < 1/2 outer ramus, inner margins of both are plumose-setose; terminal segment distinct.

Telson lobes narrowing distally, fused basally.

Barrowgammarus macginitiei (Shoemaker) (Fig. 7)

Anisogammarus macginitiei Shoemaker, 1955: 54, fig. 16;—Tzvetkova 1975: 103, fig. 37.
Barrowgammarus macginitiei Bousfield 1979: 321; Barnard & Barnard 1983: 586.

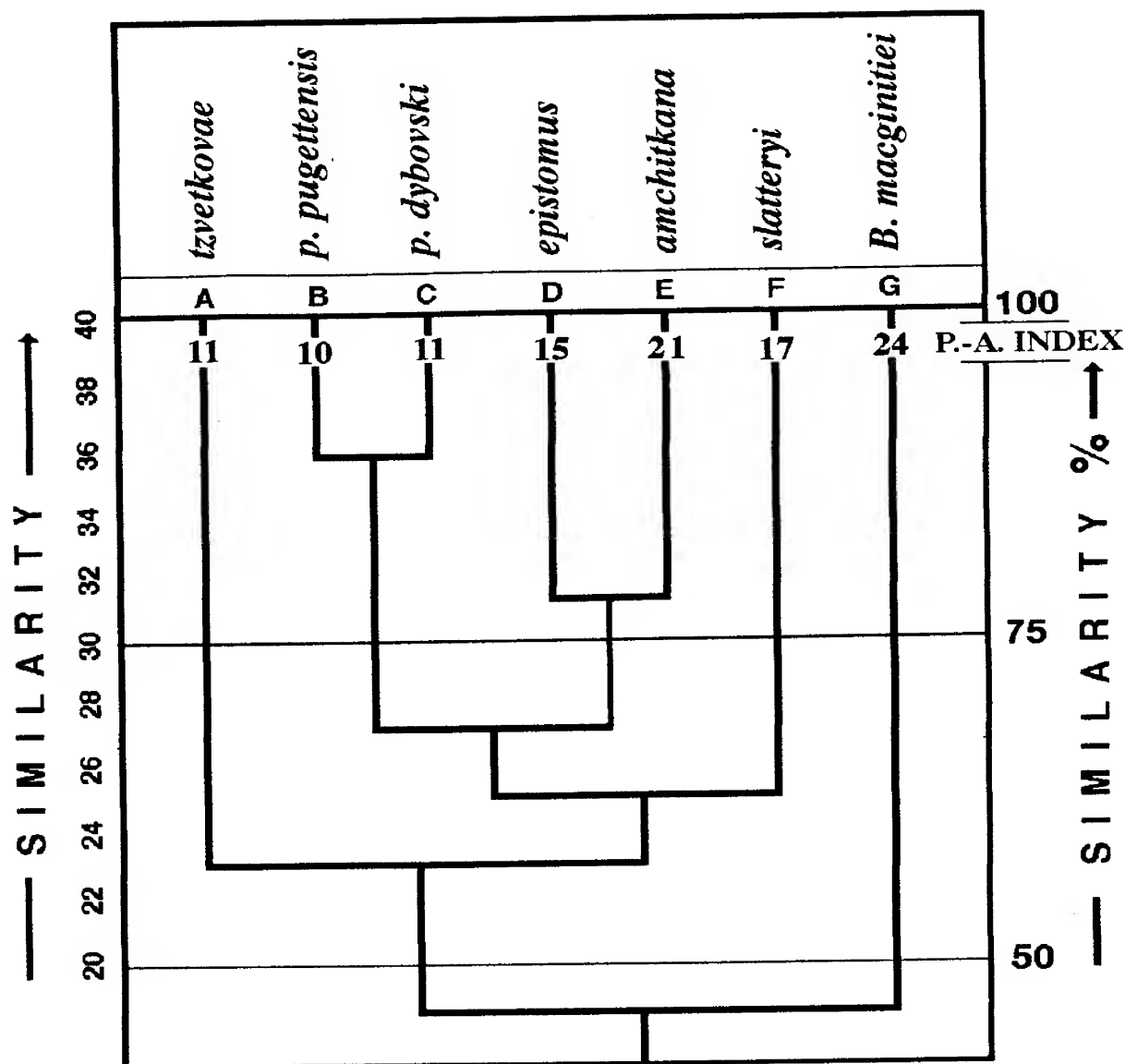


Fig. 8. Morphological similarities and possible phyletic relationships among species of *Anisogammarus* and *Barrowgammarus*.

Diagnosis: With the characters of the genus.

Distribution: Beaufort Sea, Okhotsk Sea, sublittoral.

Remarks: This monotypic taxon is undoubtedly a member of family Anisogammaridae, most closely related to the genus *Anisogammarus*, and is included here as an outgroup. The female is about the same size as the male but has not been described in detail. The presence of dorsal protruberances on urosome segments 1 & 2, and of dorsal armature on the pleosome, the form of the gnathopods (male) and the inaequiramous form of uropod 3 suggest a common ancestry with *Anisogammarus pugettensis*. Calceolation of antenna 2 (male) has not been confirmed.

Discussion.

The present treatment of anisogammarid species utilizes a semi-phyletic modification of the UPGMA system of Sneath and Sokal (1973), as in previous analyses of other North Pacific amphipod taxa. Character states are ordered plesio-apomorphically and the relative phyletic placement of a given taxon is represented by a numerical sum of plesiomorphic, intermediate, and apomorphic character state values (0, 1, and 2, respectively) in a Plesio-Apomorphic (P.-A.) Index. Tabular data on which the resulting phenograms are based are considered overly bulky and repetitive for publication here, but can be supplied on request.

Fig. 8 portrays character state similarities within the North Pacific genus *Anisogammarus* and the selected

outgroup species *Barrowgammarus macginitiei* (Shoemaker). The outgroup species, formerly *Anisogammarus macginitiei*, is now recognized at the generic level, *Barrowgammarus*, a decision in agreement with the "less than 50% similarity" that it here demonstrates with the six other species and subspecies of *Anisogammarus*. The two subspecies of *A. pugetensis*, and the species *A. amchitkana* and *A. epistomus* cluster above the 75% similarity level and these two fuse at the 68% level. The specialized sand-dwelling species *A. slatteryi* (P.-A. Index = 17) and the primitive western Pacific species *A. tzvetkovae* (P.-A. index = 12) join these at levels of 62% and 58% similarity respectively. Positive consideration of elevating some taxa to subgeneric rank might be justified. However, since other regional species may await formal recognition, elevation of taxa at this time seems premature.

The known species of *Anisogammarus* are cold-temperate (boreal) North Pacific in biogeographic affinity. They are included in an updated list of N. American amphipod species on which comparative biogeographical studies were also based (Bousfield, 2001). Four species are apparently exclusively North American, ranging from the Bering Sea region southward to northern California. Two species range from the western Bering Sea and Kamchatka peninsula, southward along the Asiatic coast to the northern Sea of Japan, consistent with the penetration of cold-water elements into that region (Derzhavin 1930). The distribution of only one full species, *Barrowgammarus macginitiei*, apparently overlaps the central Bering Sea divisional region. The biogeographic separation into eastern and western species groups appears to match the east-west distributional separation of species within other anisogammarid genera, notably the species-rich and more southerly ranging genus *Eogammarus* (Tzvetkova 1975; Bousfield 1979). However, cognizant of the current lack of a fossil record and other evidence of past distributions, reasons for these biogeographical consistencies "across the anisogammarid taxonomic board" remain speculative.

References:

- Austin, W. C. 1985. Amphipoda. In: An annotated checklist of marine invertebrates in the cold temperate Northeast Pacific. *Khoyatan Marine Lab* 3: 588-623.
- Barnard, J. L. 1954. Marine Amphipoda of Oregon. *Oregon State Monogr., Studies Zool.* 8: 9-36, 9 pls.
- Barnard, J. L. 1969. The families and genera of marine gammaridean Amphipoda. *Bull. U. S. Nat'l. Mus.* 271: 1-535, 173 figs.
- Barnard, J. L. 1975. Amphipoda: Gammaridea. pp. 313-366, pls. 70-85. In R. I. Smith & J. T. Carlton (eds). *Light's Manual: Intertidal Invertebrates of the Central California Coast*, 3rd ed. Univ. California Press: 716 pp..
- Barnard, J. L., & C. M. Barnard, 1883. FW amphipods of the World. Vols. 1 & 2: 830 pp., 50 figs. 7 graphs, 98 maps, 12 tables. Mt. Vernon, VA. Hayfield Associates.
- Barnard, J. L., & G. S. Karaman 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). Part 2. *Rec. Australian Mus. Suppl.* 13 (Parts 1 & 2): 866 pp., 133 fig.
- Birstein, J. A. 1933. Malacostraca der Kutais-Hohlen am Rion (Transkaukasien, Georgien). *Zool. Anz., Bd* 104: 143-156, 24 figs.
- Bousfield, E. L., 1958. Ecological Investigations on shore invertebrates of the Pacific coast of Canada. *Nat'l Mus. Can. Bull.* 147: 104-115.
- Bousfield, E. L., 1963. Investigations on sea-shore invertebrates of the Pacific coast of Canada, 1957 and 1959. I. Station List. *Nat'l Mus. Can. Bull.* 185: 72-89.
- Bousfield, E. L. 1968. Studies on littoral marine invertebrates of the Pacific coast of Canada, 1964. I. Station List. *Nat'l. Mus. Can. Bull.* 223: 49-57.
- Bousfield, E. L. 1977. A new look at the sytematics of gammaroidean amphipods of the world. *Crustaceana Suppl.* 4: 282-316.
- Bousfield, E. L. 1979. The amphipod superfamily Gammaroidea in the northeastern Pacific region: systematics and distributional ecology. *Bull. Biol. Soc. Washington* 3: 297-359, 12 figs.
- Bousfield, E. L. 1981. Evolution in North Pacific Marine Amphipod Crustaceans. In G.G.E. Scudder & J. L. Reveal (eds.), *Evolution Today. Proc. 2nd Internat. Congr. Syst. Evol. Biol.*: 69-89. 18 figs.
- Bousfield, E. L. 1982. Amphipoda: Gammaridea. pp. 254-285. in *Synopsis and Classification of Living Organisms*. S. B. Parker (ed.). McGraw-Hill, New York, Vol. 2.: 254-285; 293-294.
- Bousfield, E. L. 1983. An updated phyletic classification and palaeohistory of the Amphipoda. *Crustacean Issues*. A. A. Balkema, Rotterdam. 1: 257-278.
- Bousfield, E. L. 2001. Phyletic classification as applied to amphipod crustaceans of North America (north of Mexico). *Amphipacifica* 3 (1): 49-119.
- Bousfield, E. L. & N. E. Jarrett 1981. Station lists of marine biological expeditions of the National Museum of Natural Sciences in the North American Pacific coastal region, 1966 to 1980. *Syllogeus* 34: 1-66.

- Bousfield, E. L., & Shih, C.-t. 1994. The phyletic classification of amphipod crustaceans: problems in resolution. *Amphipacifica* 1 (3): 76-134.
- Dana, J. D. 1853. Crustacea. Part II. United States Exploring Expedition 14: 689-1618, atlas of 96 pls.
- Cole, G. A., 1980. The mandibular palps of North American freshwater species of *Gammarus*. *Crustaceana*, Suppl. 6: 67-83, 4 figs.
- Derzhavin, A. N. 1927. Gammaridae. Kamchatka Expedition, 1908-1909. *Hydrobiol. Jour. SSSR*, 6 (1-2): 1-15. [in Russian].
- Derzhavin, A. N. 1930. Arctic elements in the fauna of the peracarids of the Sea of Japan. *Hydrobiol. Jour. SSSR*, 8 (10-12): 326-329 [in Russian].
- Gurjanova, E. F. 1951. *Bokoplavy morei SSSR i sopredel'nykh vod (Amphipoda-Gammaridea)*. Akad. Nauk SSSR, *Opred. po Faune SSSR* 41: 1029 pp, 705 figs.
- Holmes, S. J. 1904. Amphipod crustaceans of the expedition. *Harriman Alaska Expedition*: 233--246, figs. 118-128.
- Ishimaru, S. 1994. A catalogue of gammaridean and ingolfiellidean Amphipoda recorded from the vicinity of Japan. *Rept. Sado Mar. Biol. Sta.* 24:1-86.
- Koseki, T., S. Yamanouchi, and K. Nagata, 1962. The post-mortem injury in the drowned dead body attacked by amphipods, *Med. Biol* 64 (3): 74-76 (in Japanese).
- Pearse, A. S. 1913. Note on a small collection of Amphipoda from the Pribilof Islands with descriptions of new species. *Proc. U. S. Nat'l. Mus.* 45: 571-573.
- Ricketts, E., & J. Calvin 1968. *Between Pacific Tides* (4th ed.). Stanford University Press: 614 pp.
- Shoemaker, C. R. 1955. Amphipoda collected at the Arctic Laboratory, Office of Naval Research, Point Barrow, Alaska, by G. E. MacGinitie. *Smiths. Misc. Coll.* 128 (1): 1-78, 20 figs.
- Sneath, P. H. A., & R. R. Sokal 1973. *Numerical Taxonomy*. W. H. Freeman & Co., San Francisco. 573 pp.
- Stauder, C. P. 1987. Amphipoda Gammaridea. pp. 346-391. In Kozloff, A. (ed.). *Marine invertebrates of the Pacific Northwest*. Univ. Wash. Press: 511 pp.
- Stebbing, T. R. R. 1906. Amphipoda I. Gammaridea. *Das Tierreich*: 1-806, figs. 1-127.
- Stephensen, K., 1944. Some Japanese Amphipods. *Vidensk. Medd. Dansk Naturh. Foren. Bd* 108: 25-99.
- Stimpson, W. 1857. *The Crustacea and Echinodermata of the Pacific shores of North America*. J. Boston Soc. Nat. Hist. 6: 1-92, pls. 18-23.
- Tzvetkova, N. L. 1972. K sistematike rode *Gammarus* Fabr. i novye vidy bokoplavov (Amphipoda, Gammaridea) iz severo-zapadnoi chasti Tikhogo Okeana. *Akad. Nauk SSSR, Trud. Zool. Inst.*, 52: 201-222, 7 figs.
- Tzvetkova, N. L. 1975. Littoral gammarid amphipods of the northern and far-eastern seas of the USSR and surrounding waters (in Russian). *Izdat. Nauka, Akad. Nauk SSSR*: 256 pp., 89 figs.
- Waldichuk, M., & E. L. Bousfield 1962. Amphipods in low-oxygen waters adjacent to a sulphite pulp mill. *J. Fish. Res. Board Can.* 19 (6): 1163-1165.

Legend for Figures

A1	-	antenna 1	MXP	-	maxilliped
A2	-	antenna 2	P5-7	-	peraeopods 5, 6, 7
ACC FL	-	accessory flagellum	PL	-	pleopod
ABD	-	abdomen	PLP	-	palp
BR	-	brood lamella	RT	-	right
CX	-	coxal plate	SP	-	spine
EP	-	abdominal side plate	T	-	telson
EPIST	-	epistome	U	-	uropod
GN1	-	gnathopod 1	UL	-	upper lip (labrum)
GN2	-	gnathopod 2	UROS	-	urosoma
HD	-	head	X	-	enlarged
LFT	-	left	♂	-	male
LL	-	lower lip (labium)	♀	-	female
MD	-	mandible	im	-	immature
MX1	-	maxilla 1	juv	-	juvenile
MX2	-	maxilla 2	ov	-	ovigerous
			subad.	-	subadult

The Canadian Field-Naturalist: 120 years of northern biodiversity publication.

The Canadian Field-Naturalist publishes articles and notes on original research and observations on natural history relevant to Canada (therefore on northern portions of both Nearctic and Palaearctic regions) including distribution, faunal analyses, taxonomy, ecology, and behaviour, and items of news, comment, tributes, review papers, book reviews and new titles. The official publication of The Ottawa Field-Naturalists' Club, it prints minutes of the annual meeting and awards presented by the Club. Since 1984, it has featured edited Status Reports for many individual species designated by the Convention on Species of Endangered Wildlife in Canada (COSEWIC), particularly those on fish and marine mammals. As well, recent special issues have featured the history of botanical investigation of Canada, St. Pierre et Miquelon, and Greenland; a biography of the Canadian ornithologist Percy A. Taverner, a history of the Canadian Wildlife Service, and an analysis of the Orchids of the Ottawa district.

The Ottawa Field-Naturalists' Club was formed in 1879 by scientists from embryonic federal departments, including the Geological Survey and the Dominion Experimental Farm, together with leading amateurs of the time; a similar mix remains as its strength to this day. The Club quickly emphasized publication, and for seven years beginning in 1880, it annually issued the Transactions of the Ottawa Field-Naturalists' Club. With volume 3 in 1887, the Transactions became a subtitle for Volume 1 of The Ottawa Naturalist, a new monthly publication. With Volume 3 of The Ottawa Naturalist in 1889 emphasis shifted from largely local members reports to national ones and in 1919 the journal was renamed The Canadian Field-Naturalist (starting with Volume 33 which was Volume 35 of the Transactions, although this subtitle was soon omitted). The issues per year were gradually reduced from 12 to 9 to 6 and, eventually, to 4; the latter beginning with Volume 67 in 1953, but the individual issue size increased. The annual pages published reached a record of 794 in 1988 (volume 102) and 1994 (volume 112). The largest single issue 254 pages was, however, published in 1996 as 110(1). Since 1967, the Club has separately published a local (Ottawa area) natural history journal, Trail & Landscape, now also issued 4 times a year.

Submissions to The Canadian Field-Naturalist and its predecessors have been peer reviewed since its inception, first through a "Publishing Committee", later "Sub-editors", and then "Assistant Editors" until the present designation "Associate Editors" was adopted in 1885. Currently, most submissions also go to at least one (often more) additional reviewer(s). Associate Editors are listed in every issue and, since 1982, additional reviewers been acknowledged individually in the Editor's Report annually. A formal publication policy was published in The Canadian Field-Naturalist 97(2): 231-234. "Advice to Contributors" is published in one or more issues annually giving format and charges. The journal is entirely supported through a portion of club membership (40%), subscriptions (100%), annual interest on Club investment funds (80%) and publication charges for pages and reprints. The Ottawa Field-Naturalists' Club at the beginning of 2000 had 957 members and The Canadian Field-Naturalist an additional 253 individual and 497 institutional subscribers in 22 countries, for a distribution of 1707 copies.

The current annual subscription rate is \$28 for individuals and \$45 for institutions. Membership in The Ottawa Field-Naturalists' Club (which includes receipt of The Canadian Field-Naturalist) is \$28 for individuals and \$30 for families. Postage outside Canada is \$5.00 additional. Subscriptions should be sent to The Canadian Field-Naturalist, Box 35069 Westgate P.O., Ottawa, Ontario, Canada K1Z 1A2. Manuscripts for consideration should be addressed to Dr. Francis R. Cook, Editor, Canadian Field-Naturalist, RR 3, North Augusta, Ontario K0G 1R0, Canada.

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An updated commentary on phyletic classification of the amphipod Crustacea and its applicability to the North American fauna.

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ABSTRACT

Bousfield & Shih (1994, *Amphipacifica* 1(3):76-134) provided a phyletic classification of the Amphipoda consistent with superfamily-level standards of classification in use for the Hyperiidea, Caprelliidea, Ingolfiellidea, and Gammaridea. For gammaridean amphipods, the basis for phyletic classification is reproductive form and behaviour. Detailed character-state analyses support the view that the ancestral amphipod was a "swimmer-clinger", rather than a benthic "crawler-burrower". This study comments on difficulties posed to morphological classification by near-universal occurrence of homoplasy within major character states. The present phyletic classification is here applied to a list of ~1650 scientific names of amphipod crustaceans from marine, freshwater and terrestrial habitats of North America (north of Mexico), updated to the end of the 20th century. Character state variation of antennal callynophore, brush setae, calceoli, uropods, and telson, and sexual dimorphism of gnathopods are further analysed. Suborders and gammaridean superfamilies are phyletically classified and annotated in tabular form. Although phyletic classification is presently controversial, alternative or more suitable phyletic groupings proposed by cladistic and/or rDNA analyses are yet lacking or unproven. Broad acceptance and/or usage of gammaridean superfamilies (or equivalents) outlined here provide demonstrably greater meaning and functionality to taxonomic interrelationships, and therefore greater research credibility than simple alphabetical listings of families and genera.

INTRODUCTION

Classification is the naming of essentially discreet groups of living organisms in a manner that reflects their probably correct phylogenetic history. Development of a classification requires input by scientists who are knowledgeable in animal systematics, and experienced in recognition of the significance of morphological characters and the probably correct ordering of the character states within the group concerned. Ideally, classification discriminates true phyletic relationships from homoplasious (artificial, convergent) similarities. Phyletic classification is thus distinct from, and far more useful than, an alphabetical listing of previously described taxa.

If the Darwinian theory of evolution is essentially correct for multi-cellular organisms, it follows that amphipod crustaceans evolved in only one manner, and left only one biohistorical "track record". As a corollary to that thesis, all species were at one time or another linked by so-called "intermediate" forms which, especially if extant, tend to mask the "clean" separation of lineages into pragmatically distinct clades or higher taxonomic groupings. For several reasons, however, phylogenists are unlikely to discover that record precisely. These factors include: (1) lack of a significant (long-term) amphipod fossil record (not earlier than Cenozoic); (2) incomplete description of extant taxa, especially of species from hypogean waters and the deep sea; and (3) a relatively undeveloped state of broadly applicable phyletic analysis. Clues to natural

relationships are provided mainly by analysis of external and internal morphology, behaviour, physiology, and distributional ecology of extant species.

Methods of phyletic analysis, whether intrinsic, phenetic, cladistic, genetic, or in combination, require careful research input. Particularly in treatment of speciose higher-level taxa, methodologies to date have proven neither "infallible", nor "guaranteed" to provide a realistic, credible result. Thus, in cladistic analysis, prior choice of ingroup/outgroup taxa, selection of numbers and kinds of morphological characters, and ordering of character states, all constitute subjective (and fallible) decisions that directly effect the quality of the results. Thus, sheer numbers of characters and character states, if inappropriately selected and/or wrongly ordered, may produce results that are actually misleading, internally conflicting, or otherwise of low credibility, particularly when compared with results employing other methodologies. Nor can a correct result be assumed because of the "sophistication" of methodology or computerized format.

The main text of this paper was first presented at the 10th International Colloquium on Amphipoda held at Heraklion, Crete, April 16-21, 2000. The purpose of the work is to review the status of phyletic classification of the Amphipoda, and demonstrate its applicability to a recently compiled list of amphipod families, genera, and species recorded to date from the North American continent north of Mexico.

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Compilation of the list of North American amphipods (Appendix I) involved the services of many colleagues, co-ordinated through a Committee on Scientific and Common Names of Invertebrate Animals (CNIA), chaired by Dr. Donna D. Turgeon, NOAA, Washington, DC. A full list of contributors is to be included in a final CNIA report and publication. Especially helpful to the author, who served as amphipod subcommittee chairperson and project co-ordinator, have been the following amphipod systematists: Dr. Pierre Brunel, Université de Montréal, (Atlantic gammarideans); Dr. Donald B. Cadien, Marine Biology Lab, Carson, CA (SW Pacific gammarideans); Dr. Kathleen E. Conlan and E. A. Hendrycks, Canadian Museum of Nature, Ottawa, ON (Arctic and Pacific gammarideans); Dr. John Foster, Panama City, FL (Hyperidea, Gulf of Mexico); Stephen Grabe, Environmental Protection Commission, Tampa, FL (Gammaridea, Ingolfiellidea: Gulf of Mexico); Dr. John R. Holsinger, Old Dominion University, Norfolk, VA (freshwater amphipods); Diana R. Laubitz, Canadian Museum of Nature, Ottawa, ON (Caprellidea); Sara E. LeCroy, Gulf Coast Research Laboratory, Ocean Springs, MI (Gammaridea: Gulf of Mexico); Dr. Chiang-tai Shih, Fisheries Research Institute, Taiwan (Hyperidea); and Dr. Craig P. Staude, Friday Harbor Laboratories, WA (Pacific Gammaridea).

CLASSIFICATORY SYSTEMATICS.

The malacostracan order Amphipoda has long been considered an especially difficult problem of phyletic classification (Riley 1983; Schram 1986). The problem of internal classification of this ordinal crustacean group is complicated by extreme diversity of body form ranging from thick-bodied spiny-legged burrowing haustoriids; big-eyed fast-swimming oceanic hyperiids; slender-bodied skeleton shrimps, to eyeless, vermiform infaunal ingolfiellids. How might we find commonality of relationships among widely diverse external pigmentation, from the pure white of burrowing phoxocephaloideans, through beautifully cryptic maculation of "swash-zone" pontogeneiids and calliopids, to the vertical striping of odiids and

multivariate pigmentation of "thick nosed" pleustids and minute commensal stenothoids? What natural ordering, if any, might exist between such diverse feeding types as free-swimming predaceous eusiroideans and pardaliscodeans, longicorniculate trypton-feeding podocerids, and vertically tube-building ampeliscids? Phyletic classification seeks to provide answers to these questions and bring a semblance of natural order out of almost chaotic diversity of form and behaviour.

The history of development of amphipod classificatory systems has been outlined by Bousfield and Shih (1994) and is briefly summarized here. In essence, during a period of taxonomic discovery lasting approximately two centuries since the time of Linneus (1758), phyletic (superfamily-level) classifications finally came into standard use for the Hyperidea through the work of Bowman & Gruner (1973), for Ingolfiellidea by Stock (1977), and for Caprellidea notably by Vassilenko (1974) and D. R. Laubitz (1993).

Within the diverse and taxonomically more difficult suborder Gammaridea, however, the story is more complex. For nearly two centuries (to the mid-1950's) gammaridean classification had been essentially phyletic, stabilized by the semi-phyletic, non-alphabetical arrangements of families proposed by Sars (1895) and Stebbing (1906). This system was broadly accepted and utilized by amphipod systematists at least until the early fifties (e.g., Shoemaker 1930; Gurjanova 1951; Dunbar 1954). However, two major weaknesses in these classifications remained: (1) several large families such as "Gammaridae" and "Lysianassidae" were weakly defined, effectively polyphyletic, or otherwise "unwieldy", and (2) other, mostly smaller families "begged" for inclusion within higher "umbrella" categories that would recognize their close phyletic similarities. In the second instance, Bulacheva (1957) proposed the super-family name Talitroidea to encompass the naturally related families Hyalidae, Hyaellidae, and Talitridae. J. L. Barnard (1973) combined a number of domicolous families within superfamily Corophioidea. In the first instance, the formal task of unravelling family-level units within polyphyletic family "Gammaridae" was initiated mainly by Bousfield (1973, 1977). Recombination within superfamily categories, of several older family names and those newly proposed, soon culminated in a fully phyletic classification of suborder Gammaridea (Bousfield 1979, 1982a, 1983). This classification was adopted to various degrees by Riley (1983), Schram (1986), and Ishimaru (1994). Some superfamily concepts were also revised and expanded by others [e.g., Crang-

oncytoidea by Holsinger 1992a; Lysianassoidea by Lowry and Stoddart 1997). As updated by Bousfield and Shih (1994), the "new" phyletic classification proved basically not unlike the semi-phyletic family "arrangement" of Sars (1895) and Stebbing (1906), since both recent and older systems were presumably based on similar conceptual ordering of character states of reproductive morphology and behaviour.

In the interim, however, J. L. Barnard had become dissatisfied with perceived anomalies of the Sars-Stebbing classification and the apparent intractability of their ready solution. Although he informally diagrammed suggested relationships between known amphipod families, based on a "*Gammarus*-like" prototype, he commenced listing gammaridean families and genera in alphabetical sequence (1958, 1969). The pragmatics of a simple alphabetical treatment of higher gammaridean taxa, then approaching 100 family names, was soon widely adopted. In further updatings and expansions of these original compendia (Barnard & Barnard 1983; Barnard & Karaman 1991), a number of anglicized concepts of some higher groups were proposed. These included the names "gammaridans", "hadzioids", etc., and later (Williams & Barnard 1988) "crangonyctoids", as well as a broadening of some original formal family-level concepts (e.g., Eusiridae, Corophiidae). Notably perhaps, these names corresponded, with about 75% similarity, to superfamily concepts formally proposed earlier in the phyletic literature. However, with Gordan Karaman (1991, p. 7), Barnard steered away from formal phyletic classification and concluded this final major work with an alphabetical listing of all families and component genera.

During the past two decades, some major regional faunistic studies have utilized mainly alphabetical listings and retained older treatments of higher taxa such as "Gammaridae" (e.g., Ruffo et al 1982, 1988, 1993, 1998; Camp (1998). However, with increasing sophistication of cladistic analytical methodology (e.g., Lowry & Myers, in prep.), earlier superfamily concepts are now being re-analysed [e.g., Serejo 2000 in press (Talitroidea); Berge and Vader 2000, in press (Stegocephaloidea)], and new superfamily taxa proposed (e.g., Iphimedioidea Lowry & Myers, 2000). In the light of recently proposed phyletic studies utilizing genetic methodology (e.g., Shram, 2000; Macdonald 1999), a resumption of development of phyletic classification of the gammaridean Amphipoda now seems promising.

Character State Analyses

As noted above, the present analysis of phyletic classification within the order Amphipoda is based mainly on reproductive morphology and behaviour, updated from earlier work (Bousfield & Shih, 1994). To some degree, modified repetition of material here compensates for the limited original circulation of that source paper, now out of print. The present analysis, however, utilizes only seven mostly reproductively significant, characters and character states. These include sensory organelles of the antennae (callynophore, brush setae, and calceoli); form of the telson, and degree of sexual dimorphism and use of the gnathopods during amplexus. To these has been newly added the form of the rami of uropods 1 & 2. The character states vary widely and homoplasiously from group to group, as do those of the mouthparts, coxal plates, pereopods, and uropod 3 of the earlier study. Nonetheless, collectively and judiciously, they provide a consistent and verifiable morphological basis for phyletic grouping of higher amphipod taxa.

In general, the ordering of character states is based on an assumed plesiomorphic condition in more primitive "outgroup" members of the superorder Peracarida, such as the Mysidacea and Cumacea, and more primitive members (shrimp-like groups) within the Decapoda. Thus, in members of phyletically primitive amphipod groups ("swimmers"), the sensory organelles of the antennae are well developed, the telson is typically bilobate, and sexual dimorphism of the gnathopods is rare or lacking. Since the mating process usually takes place in the open water column, precopulatory "holding" of the female by the male gnathopods is apparently not developed. Conversely, in members of phyletically more advanced gammaridean superfamilies ("crawlers"), the antennal sensory features are much reduced or lacking and the telson lobes are often fused apically. Since mating usually occurs on (or in) the bottom substrata, often in strongly lotic waters, the male gnathopods are typically strongly modified for pre-amplectic grasping and holding of the female and/or agonistic behaviour with other males.

The Antennal Callynophore

The callynophore consists of a bundle of close-set aesthetascs on the postero-medial margin of the fused (or conjoint) basal segments of the flagellum. This organelle occurs typically within pelagic ordinal groups of the higher Malacostraca and, within the Amphipoda, characterizes superfamily groups of the "Natantia", especially the Hyperiidea (Fig. 1d). Its primary func-

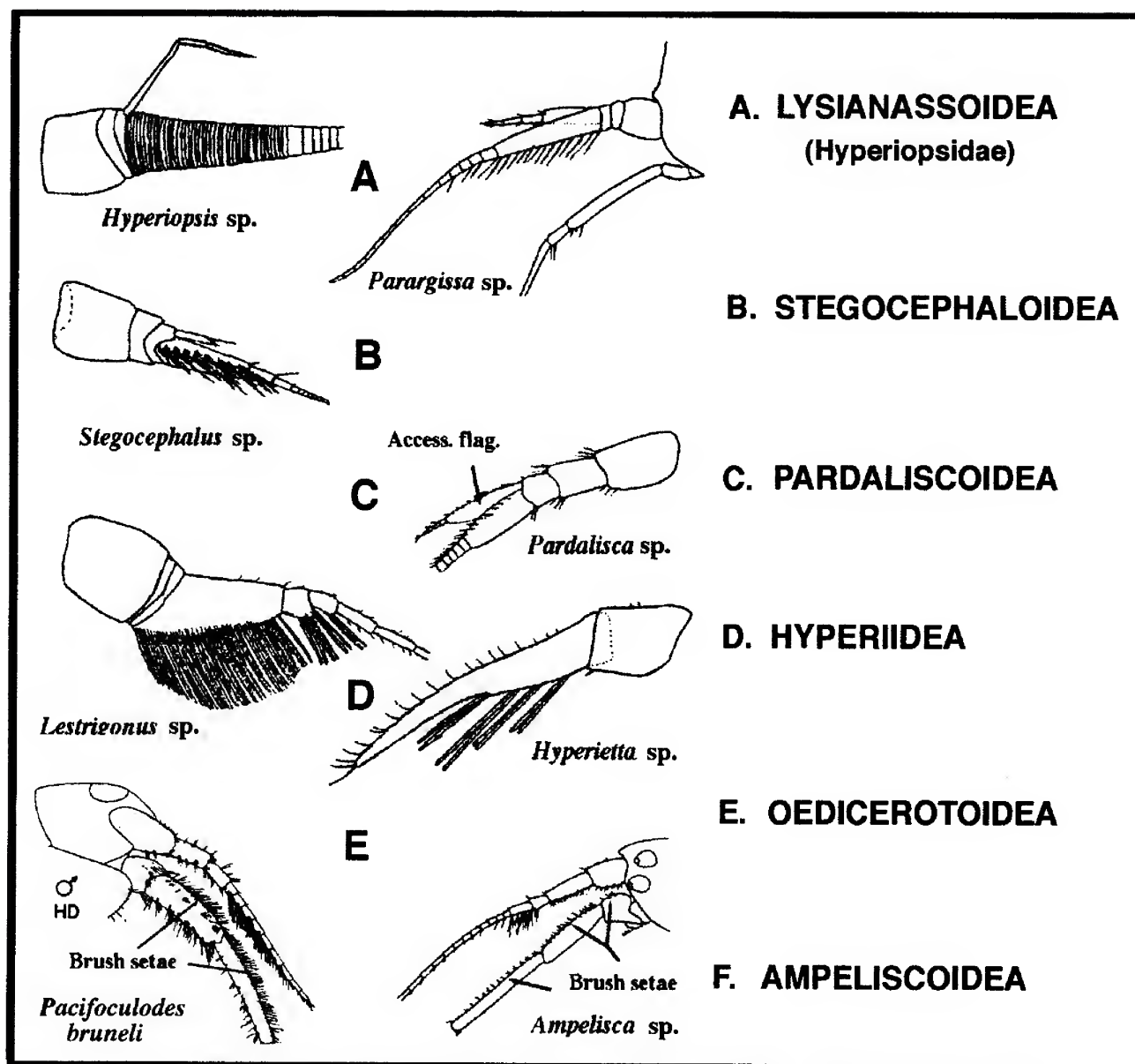


Fig. 1. Types of antennal callynophores [after Barnard (1969), Bowman & Grüner (1973), Bousfield & Chevrier (1996), and unattributed sources].

tion is almost certainly chemosensory. Its presence mainly in the final adult male instar would seem to be of direct reproductive significance in the detection of females within the water column. However, in some lysianassoidean and synopioidean subgroups, callynophore-like structures may also be present in mature females and subadult stages, perhaps indicating a possible secondary role in detection of food resources.

Representative forms of callynophores within the Amphipoda are illustrated in Fig. 1. Lowry (1986) has described a one-field arrangement of the callynophore within families Platyschnopidae, Urothoidae and Phoxocephalidae (Phoxocephaloidea), a condition he considers primitive, and in some hyperiids (e.g.,

Archaeoscinidae), perhaps convergently. In all other taxa the arrangement is two-field.

The possible significance of the callynophore in phyletic classification was first introduced by Lincoln and Lowry (1984) and amplified formally by Lowry (1986). Although strongly developed in pelagic carnivores and necrophages, especially where calceoli are weak or lacking (e.g., Synopioidea, Pardaliscoidea, Stegocephaloidea, and Hyperioidea), the organelle is generally weak or lacking in reproductively pelagic but vegetatively benthic groups such as the nestling Dex-aminoidea and tube-building Ampeliscoidea, and in the fossorial Phoxocephaloidea and Pontoporeioidea. It is virtually lacking in several "natant" subgroups

where the entire life cycle is essentially infaunal (e.g., Haustoriidae), or commensal or parasitic (e.g., some Lysianassoidea) and/or where preamplifying reproductive behaviour has secondarily and convergently developed (e.g., Paracalliopiidae and Exoedicerotidae within Oedicerotoidea). Curiously, the callynophore is surprisingly weakly developed in the mainly marine but mainly acalceolate family Oedicerotidae and even within the Eusiroidea (e.g., in the pelagic, primitive family Eusiridae, but not found in Pontogeneiidae, nor Calliopiidae).

The callynophore is essentially lacking in reproductively benthic Reptantia, including the Caprellidea and Ingolfiellidea, and not found in freshwater taxa, even in those that have apparently become secondarily pelagic such as *Macrohectopus* within the Gammaroidea. However, callynophore-like structures have been reported from a few Amphilochidae (e.g. *Austrophaeonoides*, *Peltocoxa*) and Cressidae (*Cressa cristata*) within primitive subgroups of superfamily Leucothoidea (Lowry 1986).

The presence or absence of a callynophore may therefore offer a useful criterion of reproductive life style. Although its occurrence appears subject to homoplasious tendencies, such aberrancies may be correlated with non-reproductive features of life style and are thus predictable. In broader perspective, the presence of a callynophore is a plesiomorphic, or basic feature of malacostracan reproductive morphology. As concluded previously (Bousfield & Shih 1994), the callynophore provides a primary basis for development of a phyletic classification within the Amphipoda.

Antennal Brush setae

The term "brush setae" applies to dense tufts or clusters of short brush-like setae that variously line the anterior margins of peduncular segments 3, 4, and 5 of antenna 2. Brush setae may occur also on the posterior (lower) margins of peduncular segments 1-3 of antenna 1 (e.g., in Dexaminoidea). Similar types of setae occur in other peracaridan taxa, including the Cumacea and Mysidacea.

Within the Amphipoda these organelles have been found only in the terminal male stage of pelagically reproductive amphipod superfamilies, and not in sub-adult males, females, and/or immature stages. Their function is yet unknown and conjectural. Although brush setae may not have been studied in ultrastructural detail, their gross morphology is similar to modified setae rather than thin-walled aesthetascs. Their role may be tactile when, during the process of copulation,

the male is briefly in close contact with the female.

The potential usefulness of brush setae in phyletic classification was previously suggested by Bousfield (1979); Bousfield & Shih (1994). These organelles are most strongly developed in non-calceolate primitive superfamilies of Natantia (e.g., Pardaliscoidea, Synopioidea), and moderately developed in some calceolate "natant" taxa (e.g., Lysianassoidea, Phoxocephaloidea, Eusiroidea, Oedicerotoidea), and acalceolate "transitional" super-families (e.g., Dexaminoidea, Ampeliscoidea, and Mel-phidippoidea). They are less well developed or rare within the Stegocephaloidea and Hyperioidea (Fig. 1).

The presence of brush setae in males only indicates that their function is reproductively significant. Their limited distribution within the Natantia and total absence from the Reptantia indicates a potentially primary value in phyletic classification.

The Antennal Calceolus

The calceolus is a slipper-shaped membranous microstructure attached variously to the anteromedial segmental margins of the flagella and peduncles of both antenna 1 (antennule) and antenna 2 of some gammaridean Amphipoda. Principal features of these micro-structures have been described, across a broad range of higher taxa, by Lincoln and Hurley (1981) and, with special reference to genera within the primitive "reptant" superfamilies Crangonyctoidea and Gammaroidea, by Godfrey *et al* (1988). The calceolus is not to be confused with the aesthetasc, a sublinear thin-walled microstructure of mainly chemosensory function, found only on flagellar segments of antenna I in most species of Amphipoda. The aesthetasc also occurs widely across malacostracan ordinal subgroups, including the Decapoda. The calceolus is also structurally readily distinguishable from brush setae and other seta-like structures co-occurring on antennal peduncular and flagellar segments.

Representative types of amphipod calceoli are illustrated in figs. 2 & 3. Calceolus-like structures are found on the proximal flagellar segments of antenna 1 (male) of a few other malacostracans, notably within the Syncarida (e.g., *Koonunga cursor*) and the Mysidacea (e.g., *Xenacanthomysis pseudomacropsis*). Such structures are not considered calceoli by Lincoln (*pers. commun.*) since they may be convergent in form and/or of different function. However, these organelles are included here as of possible phyletic significance within the Malacostraca and, in my view, merit further comparative micro-anatomical and behavioural study.

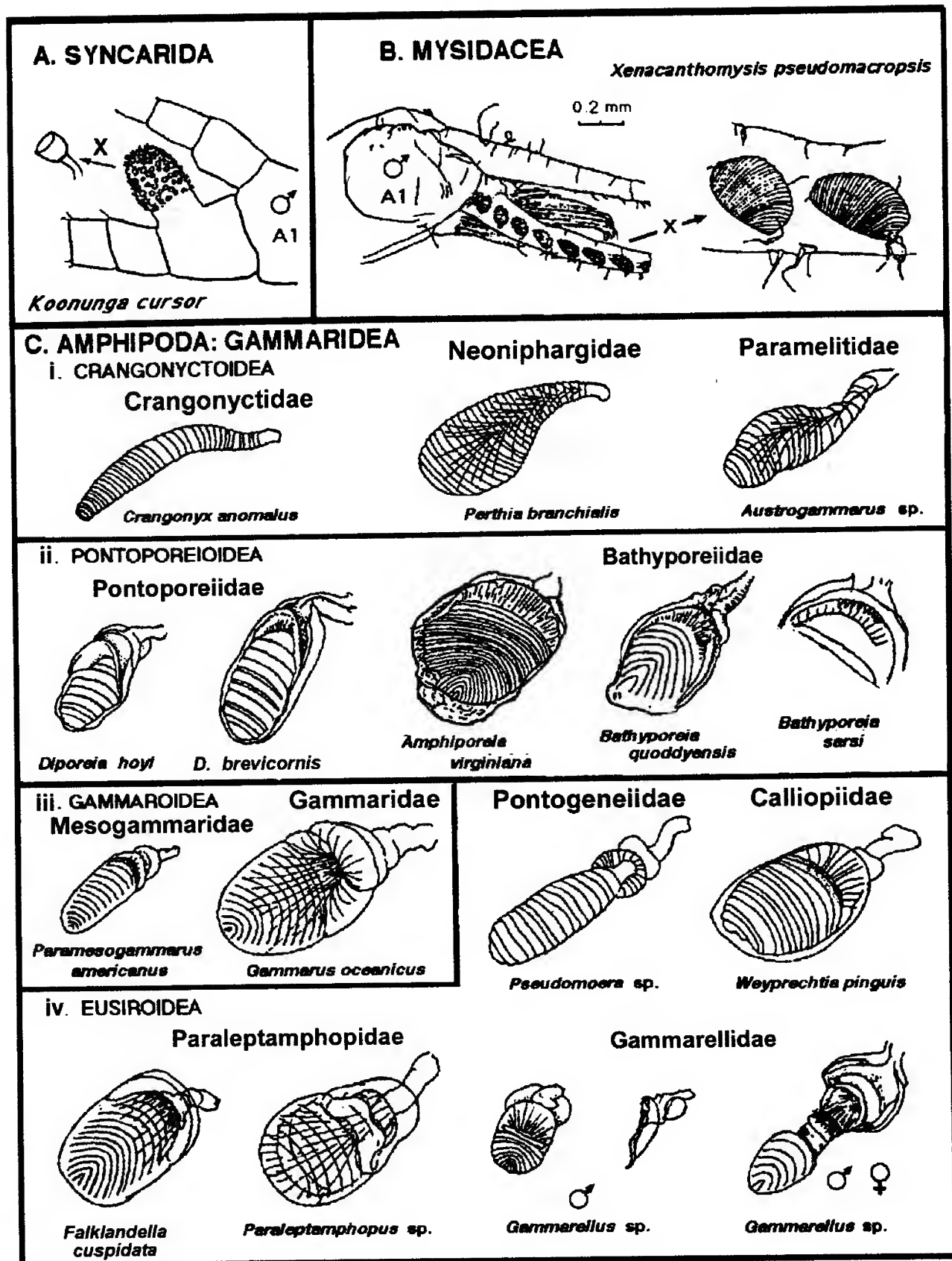


Fig. 2. Types of antennal calceoli in gammaridean Amphipoda, and positionally similar organs in other malacostracan Crustacea (modified from Bousfield & Shih 1994).

The presumed "advanced" form of the calceolus is grossly similar to that of a parabolic radar "dish" (Fig. 2C,D). Combined with its anterior antennal location, this morphology suggests that the organelle functions primarily as a mechanoreceptor for aquatic acoustical vibrations. However, its innervation and connection to the brain has not yet been ascertained, nor have microacoustical studies yet confirmed its true function (Lincoln & Hurley 1981).

The distribution of calceoli between the sexes suggests that calceoli developed initially in males only, presumably as a device for detection of vibrations from swimming females of its own species. In free-swimming raptors (e.g., Gammarellidae within the Eusiroidea), special types of calceoli have apparently developed in females and immatures, and occur alongside the reproductively functional form of calceolus in terminal stage males. As described by Steele & Steele (1993), these organelles appear to have become more complex structurally, presumably, and possibly secondarily adapted, for detection of escape vibrations of free-swimming prey. However, the primary reproductive function of calceoli apparently diminished or disappeared in concert with changes in life style from pelagic to benthic, neritic to abyssal, lotic to lentic, marine to freshwater, epigean to hypogean, and corresponding development of pre-amplexing gnathopods (see p. 61). As indicated in Fig. 3, reduction and disappearance of calceoli occurred initially in antenna 1 and subsequently in antenna 2. Within the latter, the sequence of loss was initially from the peduncle and distal flagellar segments, and finally from the proximal flagellar segments. However, as noted above, calceoli persisted in both males and females of some epigean freshwater groups (e.g., some Gammaridae, Anisogammaridae) and/or cave pool amphipods where life styles presumably remained free-swimming and raptorial (e.g., *Crangonyx packardii* and *Sternophysinx calceola* (Crangonyctoidea); *Sensonator valentiensis* (Melphidippoidea?), and several eusiroideans of southern continental land masses (Bousfield 1980).

The possible significance of antennal calceoli in phyletic classification of the Amphipoda has been alluded to variously by Bousfield (1979, 1983), Lincoln and Hurley (1981), Lincoln & Lowry (1984), and more recently by Godfrey et al. (1988), Stapleton et al. (1988), Holsinger (1992a), and Steele & Steele (1993). These views were analysed and expanded upon by Bousfield & Shih (1994) and are here summarized and updated, with special application to the North American amphipod fauna (Appendix I).

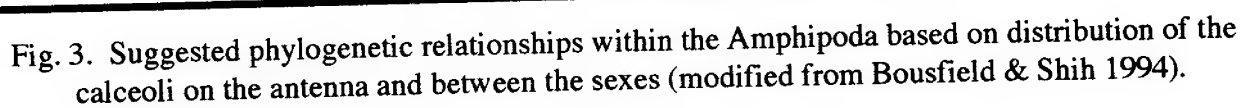
The external morphology of the calceolus within the primitive reptant superfamily Crangonyctoidea (category 9, Lincoln and Hurley 1981) appears to be the most simplified, and thus probably the most plesiomorphic extant form (Figs. 2 A & 3). It consists only of a basal stalk and elongate body that bears numerous (20+) elements of similar simple structure. Holsinger (1992a) has distinguished two subcategories of calceoli within the Crangonyctoidea. In members of holarctic family Crangonyctidae (*Crangonyx*, *Synurella*, pp. 101-104) the form is slender and elongate, with a simple branched internal "tree trunk" configuration. Some separation of basal elements in *Crangonyx richmondensis*, illustrated by Godfrey et al. (1988), are suggestive of "protoreceptacles". By contrast, the calceolus within austral families Sternophysingidae and Paramelitidae is typically broad, paddle-shaped, and its internal tree-trunk configuration has more numerous indistinct branches, a seemingly more plesiomorphic condition. In slightly more advanced types of calceoli (Fig. 3, upper: Phoxocephaloidea), the elements are fewer (10-15 in Platyschnopidae; 4-6 in Phoxocephalidae) and the body may be short and spatulate, or barrel-shaped.

With respect to the sexes, the more plesiomorphic types of calceoli occur (with very few exceptions) in the 'males only' category of presumed most primitive superfamily taxa such as the Crangonyctoidea, Phoxocephaloidea, Pontoporeioidea, and most of the Lysianassoidea (Fig. 2, i, ii; Fig. 3, upper two rows).

In more advanced types of calceoli (Fig. 2, iii), the basal element is broadened and forms a receptacle that is weakly developed in Pontoporeioidea and Gammaroidea but strongly so in Eusiroidea (Fig. 2, iv). The basal stalk is distally expanded into a bulla or resonator, weakly and more strongly in those same groups respectively. In some Pontoporeioidea (Bathyporeiidae), finger-like processes protrude over the proximal elements. In the most advanced types of calceoli (viz., in some Eusiroidea: Gammarellidae, Eusiridae), and in some pelagic Lysianassoidea (e.g., *Ichnopus* spp., Lowry and Stoddart 1992), the distal elements are few and widely separated from one or more large, cup-shaped receptacles, and the bulla may be prominent.

The evolutionary morphological sequence within calceoli portrayed here is believed to match more closely the phylogeny of corresponding superfamily groups, based on other character states (see below), than does the somewhat pragmatic sequence originally provided by Lincoln and Hurley (1981).

A graphical plot of the types of calceoli and their



distribution by antennal site, sex, and higher taxon, can be linked by means of a branching arrangement with relationships that, in part, are remarkably similar to phyletic arrangements derived elsewhere from analysis of other character states (Fig. 3). In the first two categories, this arrangement goes somewhat beyond the relationships proposed by Lincoln & Lowry (1984) on the basis of the taxonomic (classificatory) distribution of calceoli. In the present chart, the positions of the major taxa in the various "boxes" are correlated primarily with the distribution (or lack) of calceoli on one or other (or both) antennae, along the horizontal axis and with the morphological type and its sexual occurrence, on the vertical axis. The vertical and horizontal axes also simulate, fanwise, an approximate evolutionary time scale for the probable first appearance of the ancestral type of each major taxonomic group.

The arrangement of calceoli is here rooted in a presumed mysid-like out-group in which calceolus-like structures are known, at least on antenna 1 of the male. Such structures may have occurred in presumed former epigean and pelagic marine ancestors of the now hypogean relict suborder Ingolfiellidea, and of the continental freshwater-endemic Crangonyctoidea. Such epigean and marine ancestral types have not yet been found extant, or in the fossil record, but are predicted from this study and from earlier considerations (e.g., Bousfield 1982b). In this two-dimensional scheme, all members of the seven calceolate superfamilies, and the enigmatic hypogean calceolate *Sensonator valentienensis* Notenboom, 1986 (Melphidippoidea?), cannot be confined cleanly within any given graphical box. Such variance is attributable to parallel development, diversification, and subsequent loss of calceoli from the antenna of both sexes, presumably in response to changing life styles within the various taxonomic subgroups (above). Notably, the more strongly calceolate superfamily groups (calceoli on both A1 and A2, left column) are those in which members are primarily pelagic and/or reproduce freely in the water column. These include most Phoxocephaloidea, Pontoporeioidea, Lysianassoidea, Eusiroidea, and Oedicerotoidea. The less strongly calceolate superfamilies (with rare exceptions, calceoli on A2 only, right column) are found in the most primitive members of benthic superfamilies of the Reptantia (Crangonyctoidea, Gammaroidea). The position of acalceolate superfamilies is tentative, but is suggested partly by the presence or absence of other presumably plesiomorphic, often vestigial characters such as antennal callynophore and brush setae (above).

The presence or absence and type of antennal calceolus are character states of undoubted phyletic

significance. However, their restricted distribution among extant gammaridean superfamilies limits their use to cases of phyletic classification where other parameters of broader classificatory applicability (e.g., form of uropods, coxal plates, gnathopods) are known.

Uropods 1 & 2.

The uropods of amphipods are biramous appendages of the three posterior abdominal segments. They function mainly in forward propulsion during swimming or crawling activities. The uropods are well developed and conspicuous in most gammarideans, hyperiideans, and ingolfiellideans, but minute or lacking in caprellideans. The rami are seldom equal in size, the outer usually being noticeably the shorter. Only within the Ingolfiellidea is uropod 2 typically larger than uropod 1.

Morphological variation in the rami of uropod 3 and its utilization in phyletic classification have been analyzed previously (Bousfield and Shih 1994). In this study, the form and armature of the rami of uropods 1 & 2 are similarly investigated. In nektonic forms, the rami are often lamellate or lanceolate, whereas in benthonic crawling or burrowing forms the rami are typically styliform (Schram 1986). The rami may also be modified for specialized functions in domicolous and/or commensal species, and for presumed copulation (in males) widely across the taxonomic spectrum (e.g., in some Lysianassoidea, Crangonyctoidea, Talitroidea, and Gammaroidea). At higher taxonomic levels, armature of the peduncle may also prove phyletically significant, particularly the development of baso-facial spine(s) in gammaroidean superfamilies, and distolateral spines in gammaroideans and some fossorial superfamilies (e.g., Phoxocephaloidea and Pontoporeioidea).

Figure 4 illustrates three main types of rami of uropods 1 & 2 and their occurrence in representative gammaridean superfamilies. Lanceolate rami (A) are generally slender and taper distally to an acute apex that lacks distinct apical spine(s) or spine clusters; marginal spines (when present) are typically arranged in opposing, evenly spaced series. Lanceolate rami typify the most primitive superfamilies of reproductive "swimmers" (Natantia), including the Lysianassoidea, Phoxocephaloidea, Pardaliscoidea and most Eusiroidea. Linear rami (C) are generally thick and robust (styliform), with subparallel margins that tapering only slightly distally; the apex is rounded or blunt, and usually bears a distinct cluster of spines of unequal length. These rami typify mostly benthonic crawling or burrowing superfamilies, with reproductively pre-

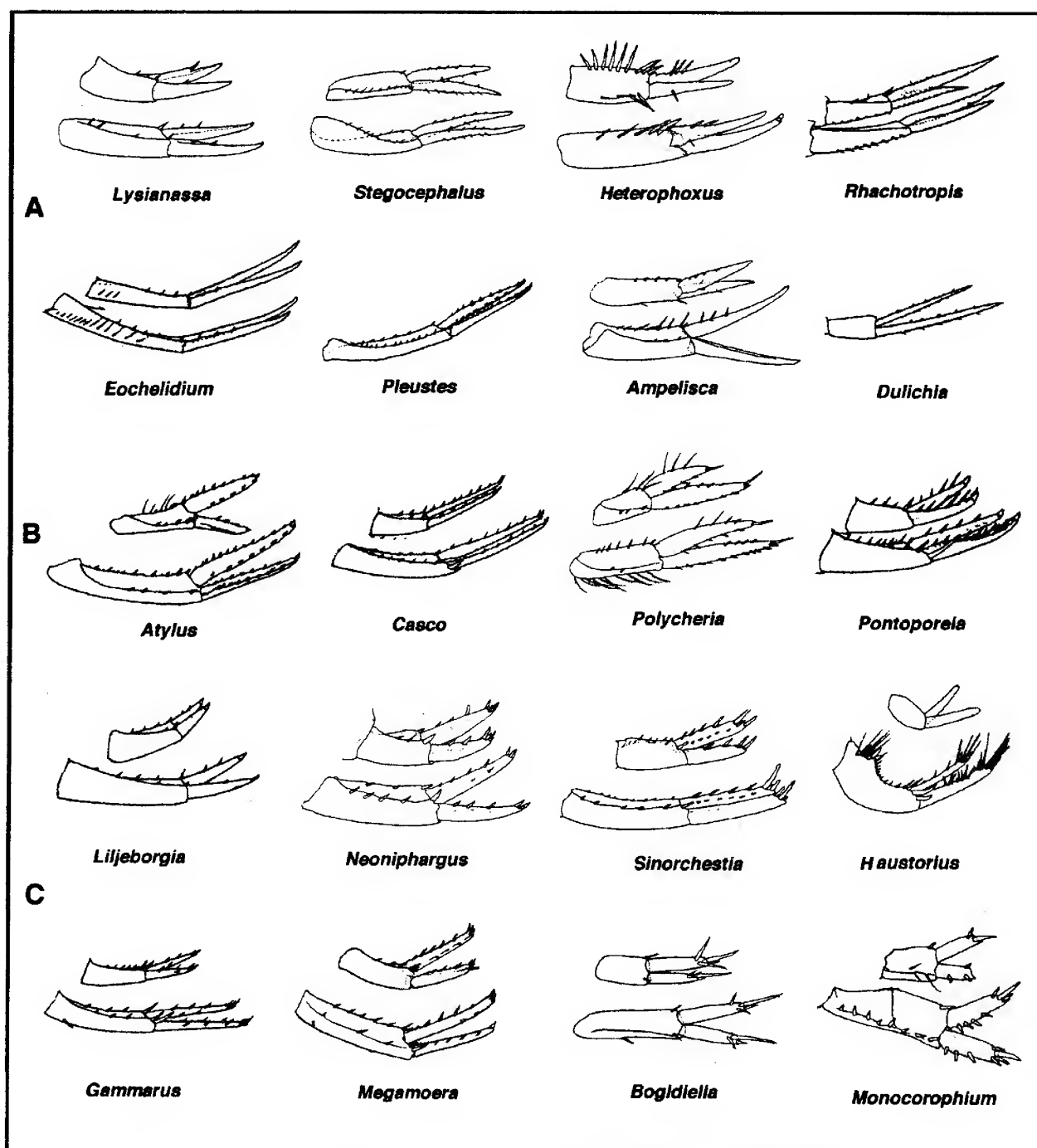


Fig. 4. Form of rami of uropods 1 & 2. A. Lanceolate; B. Transitional; C. Linear.
(After Bousfield (1973) and unattributed sources)

amplexing gnathopods (Reptantia), such the Crangonyctoidea, Talitroidea, Gammaroidea, and Corophioidea. Transitional rami (B) taper variously to a subacute apex that may bear a single spine or a few very short spines; marginal spines are usually present and serially arranged (e. g., Dexaminoidea and Melphidipoidea).

The form and armature of the rami of uropods 1 &

2 apparently transcends these categories within a few gammaridean superfamilies (e.g., Pontoporeioidea). Also, within family Podoceridae, the dulichiid subgroup possesses lanceolate uropod rami that are atypical of superfamily Corophioidea, to the other character states of which the dulichiids conform reasonably well. The vestigial uropod rami of cercopid caprellidean amphipods are also lanceolate. Such a character state

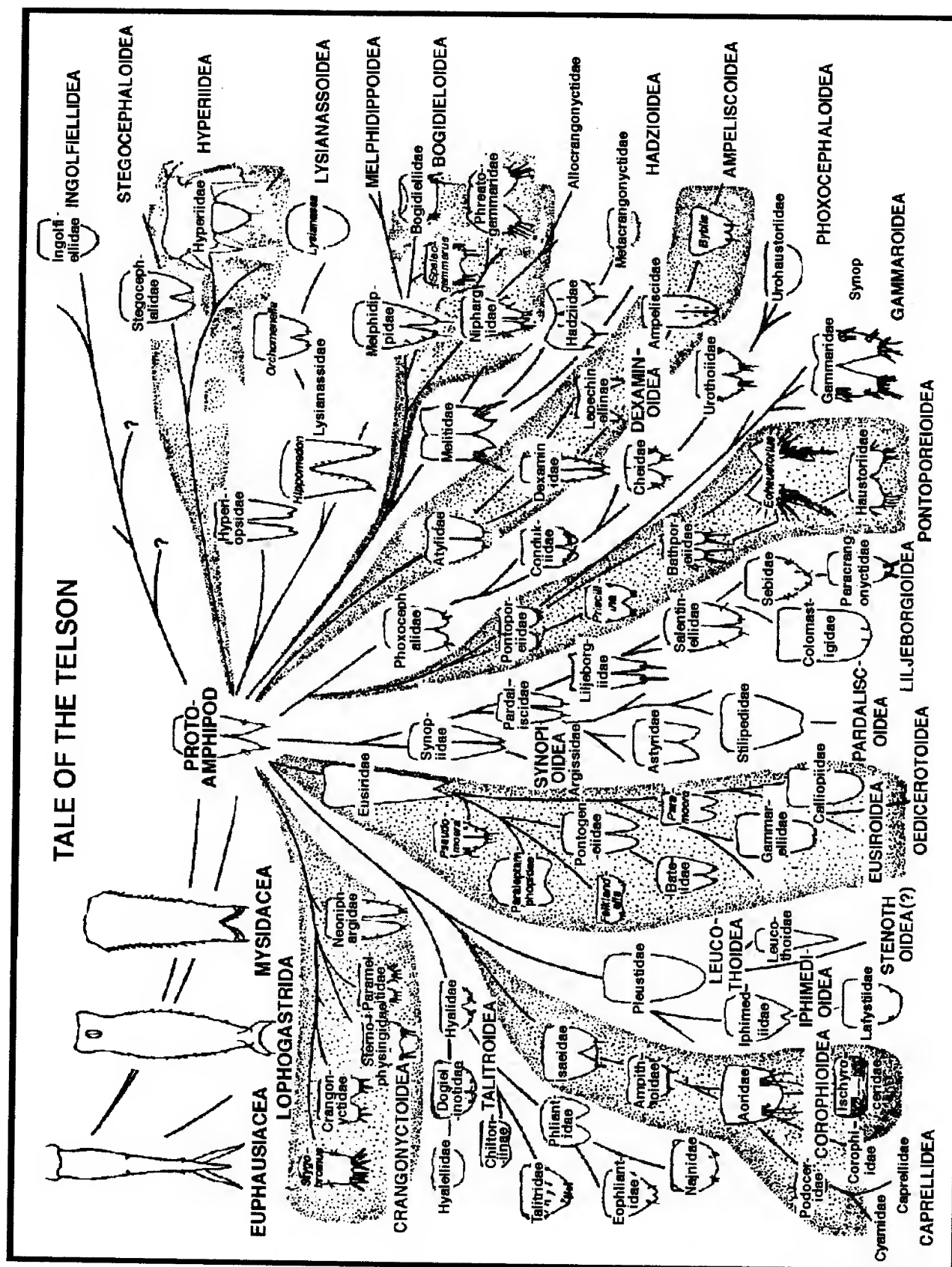


Fig. 5. Suggested evolutionary relationships of the telson within the Amphipoda.
(modified from Bousfield & Shih 1994).

"anomaly" apparently supports direct phyletic ancestry of dulichiids to the cercopid line of Caprellidea, as proposed by Laubitz (1993). It may suggest a possible diphyletic origin of the Corophioidea, and consideration of a possible leucothoidean ancestry for the dulichiid podocerids (see fig. 7; Bousfield & Shih 1994).

However, broadly across families of most gammaridean superfamilies, the uropod ramal condition is remarkably stable and correlates well with the phyletic status of other character states in those same taxa. Thus, the lanceolate condition is typical of superfamilies that exhibit plesiomorphic states of antennal sensory organelles and sexually similar gnathopods. Conversely, the linear ramal condition is associated most frequently with apomorphic reduction of antennal sensory organelles, presence of sexually dimorphic gnathopods, and reproductive pre-amplexing behaviour. Not surprisingly, the transitional ramal form occurs mainly in higher taxa with a phylogenetically "intermediate" status of other character states. Thus, the form and armature of uropods 1 & 2 appear to be character states of high-level classificatory significance.

The Telson.

The form of the telson has long been considered a character of prime taxonomic significance (Stebbing 1906; Barnard & Karaman 1991). Its probable function in both free-swimming and benthonic life styles, and its overall significance in superfamily level classification has been reviewed by Bousfield & Shih (1994). The deeply bilobate form is generally deemed the plesiomorphic condition within amphipodan, peracaridan, and indeed, all malacostracan crustaceans (Schram 1986). Conversely, the entire, platelike, or "fleshy" form of the telson, presumably represents a distal fusion of the two primary lobes (e.g., as in superfamilies Leucothoidea and Corophioidea respectively) and thus the typical apomorphic state. A very advanced condition is seen in the Thaumatesonidae and many Hyperiidea, where the plate-like telson is fused with the urosome. A less frequent but presumably apomorphic condition occurs where the lobes become separated throughout their entire length (as in most Gammaroidea and certain Hadzioidea) and attains an extreme separation dorsally on urosome 3 (abdominal segment 6) in the advanced fossorial genus *Eohaustorius* (Pontoporeioidea).

A panoramic view of telson types across the spectrum of higher amphipod taxa is provided in Figure 5. The prototype amphipod is depicted with a bilobate

telson, the apex of each lobe having a "notch and spine" configuration derived from a presumed pelagic peracaridan (primitive malacostracan) ancestral outgroup. Following evolutionary lines outwards from this base through each superfamily group, we find that member species and genera having the greatest number of plesiomorphic character states (those nearest the base) also tend to have a fully or partially bilobate telson. Conversely, member species and genera with the most apomorphic or derived character states, in balance, usually show the most strongly fused or plate-like form of the telson. The totally bilobate apomorphic form may be noted in advanced members of the Gammaroidea and in some members of the Pontoporeioidea (family Haustoriidae).

However, the overall form of the telson proves not directly significant in development of a phyletic classification. As noted in fig. 5, development of a plate-like telson takes place independently and homoplasiously within nearly every superfamily group. Derivation of a superfamily group based solely on a plate-like telson would encompass members of at least ten different major groups, and thus be totally artificial. However, within component families of the most primitive superfamilies of "Natantia" (e.g., Lysianassoidea, Phoxocephaloidea, Eusiroidea, Pardaliscoidea) the deeply bilobate form of the telson is dominant. Conversely, within the more advanced "natant" superfamilies such as the Oedicerotoidea and Leucothoidea, the Hyperiidea, and among most reptant superfamilies (e.g., Crangonyctoidea, Talitroidea, Bogidielloidea, Corophioidea), the distally notched or plate-like form is dominant.

Despite contrary views of some (e.g., Barnard & Karaman 1981, 1991), the balance of evidence strongly supports the overall conclusion that a deeply bilobate telson is the plesiomorphic or ancestral condition within the Amphipoda. Conversely, a plate-like or apically entire telson is the apomorphic or advanced condition. However, structure of the telson appears to be more dependent upon factors of life-style at lower taxonomic levels rather than the more broadly "stable" features of reproductive biology. Character states of the telson may therefore be phylogenetically significant only at family, subfamily, or even generic classificatory levels.

Phyletic Significance of Gnathopod Structure

The external morphological features of the gnathopods (peraeopods 1 & 2 of formal malacostracan terminology) have previously been considered one of the most significant and fundamental indicators of high

level phyletic relationships within suborders Gammaridea (Stebbing 1906); Barnard & Karaman 1991) and Caprellidea (Laubitz 1993; Takeuchi 1993). A cross-section of amphipod gnathopod types was also analyzed by Bousfield & Shih 1994.

Early taxonomic studies had long detailed the sexually dimorphic, powerfully subchelate form of the gnathopods of intertidal and freshwater species of *Gammarus* of northwestern Europe. In females and immature stages, these anterior appendages were used mainly as implements of food-gathering but, in sexually mature males, are utilized in precopulatory carrying of the female, thus ensuring close proximity of the sexes at the time of her "mating" moult (ecdysis). Justified or not, *Gammarus* was considered by many workers to be the basic or ancestral amphipod reproductive form (e.g., Barnard 1969).

More recent studies (e.g., Borowsky 1984; Conlan 1991a) have investigated gnathopod morphology and sexual dimorphism across a broad spectrum of amphipod superfamilies. The results have been compared with a pre-amplexing and/or mate-guarding form of reproductive behaviour in species of *Gammarus* of northwestern Europe. As indicated by Schram (1986), this form of reproductive behaviour is now considered by most workers as relatively highly evolved and specialized within the Amphipoda.

The search for a probable ancestral form of the gnathopods first centred on members of superfamilies that were classified as primitive on the basis of other plesiomorphic character states. Over a range of family and generic morphotypes within the primitive superfamily Lysianassoidea (e.g., Barnard and Ingram 1990; Lowry & Stoddart 1997), the distal portions (carpus, propod and dactyl) of both gnathopods in both sexes, are found to be consistently subsimilar. Despite minor modifications within an increasingly sophisticated generic series, the plesiomorphic form of both gnathopods may be described as weakly subchelate, with slender carpus and propod, and clearly not sexually dimorphic. Within the Lysianassoidea, mating takes place freely and rapidly in the water column, there is no pre-amplexus or mate-guarding phase, and by corollary represents the plesiomorphic reproductive (mating) behaviour.

Amphipod superfamilies grouped within the category Natantia (Table I, p.67) are typified by pelagic reproductive (mating) behaviour, and by nonsexually dimorphic gnathopods that are primitively weakly subchelate and subsimilar in form. Exceptions can be explained, at least tentatively, on the basis of (1)

independent or convergent evolution within geographically isolated sub-taxa that have been exposed to similar, mainly ecological, evolutionary stresses (e.g., southern families of Oedicerotoidea); (2) a morphological vestige of presumed ancestral types whose evolutionary "thrust" devolved mainly into other superfamily groups that are, today, essentially "reptant" in reproductive life style (e.g., in Pontoporeiidae); or (3) a probable extant precursor of more widespread and diverse modern taxonomic groups (e.g., in Dexaminoidae, Melphidippoidea).

Within subcategory Reptantia, gnathopod morphology is basically different, and the range of morphotypes is considerably greater than seen in the Natantia (Bousfield & Shih 1994). Thus, in most component superfamilies the gnathopods are characteristically sexually dimorphic and strongly subchelate or cheliform, especially in males. However, many exceptions to these overall trends have been noted. These plausibly include a secondary use of sedimentary benthic substrata as a "fluid" mating medium wherein sexually dimorphic gnathopods and pre-amplexing mating behaviour may not be required (e.g., in Haustoriidae).

In summary, within component superfamilies of Reptantia, sexual dimorphism of the gnathopods, and benthic pre-amplexing reproductive styles are typical. These types are mainly vegetatively free-living and epigeal in physically rigorous habitats such as coastal shallows, estuaries, and fresh-waters. Conversely, in members that have become secondarily commensal with other marine animals or plants, penetrated into hypogean brackish- and fresh-water or the deep sea, or have become fully terrestrial, sexual dimorphism of the gnathopods is markedly reduced or lacking. Secondly and neotenually, the sexually dimorphic form may revert to a morphology suited to the vegetative life style of both sexually mature adults and immature stages.

Mating Behaviour Within the Amphipoda

The significance of precopulatory mating behaviour and sexual dimorphism in phyletic relationships of amphipod crustaceans has been broadly investigated by Conlan (1991) and summarized by Bousfield & Shih (1994). To ensure proximity of males and females at the time of female ovulating ecdysis, amphipods employ two basic reproductive strategies: (1) mate-guarding, in which the males are either (a) carriers involving pre-amplexing, with concomitant modification of male gnathopods for the purpose, or (b) attenders, where they remain domiciled with the fe-

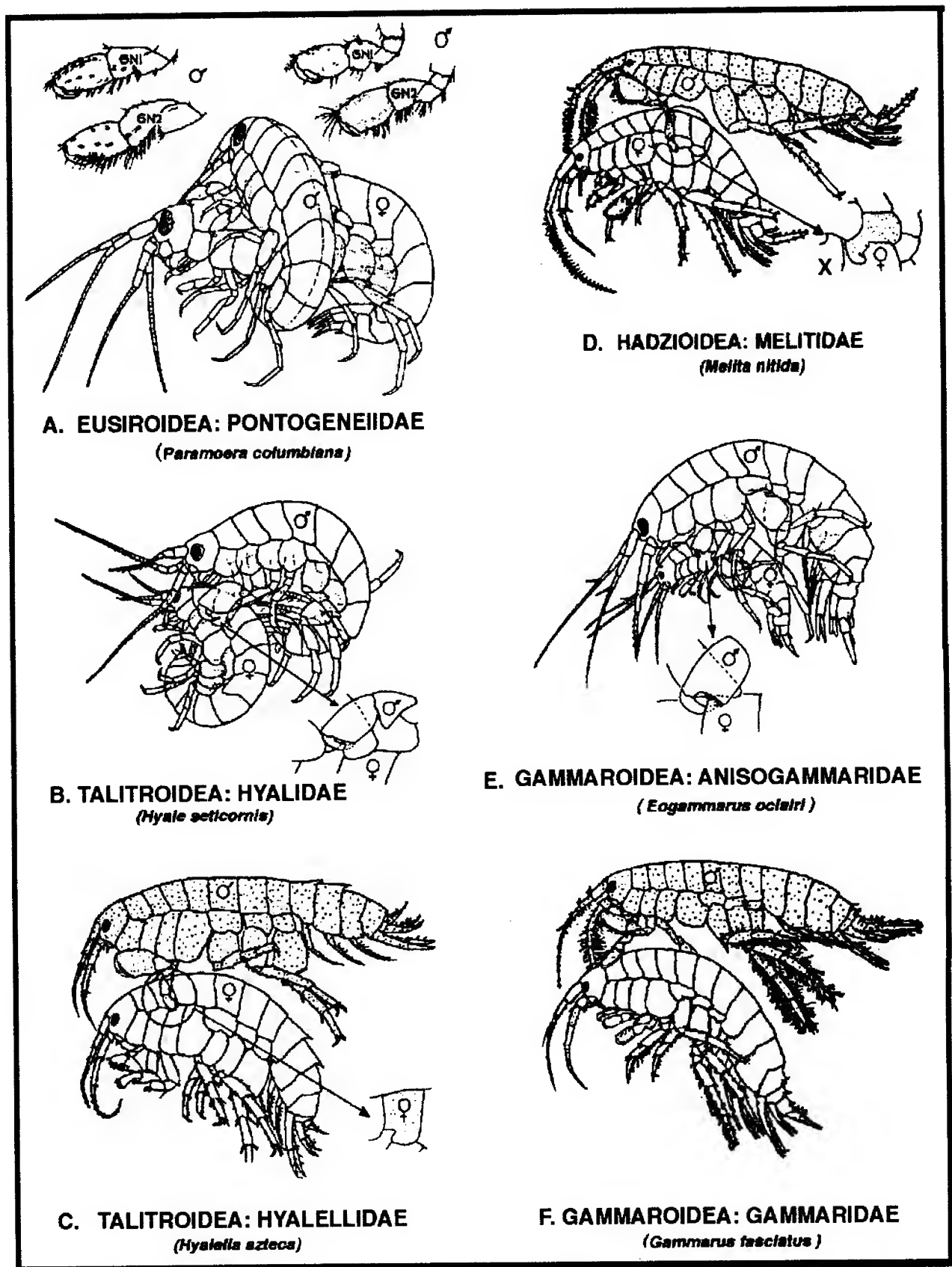


Fig. 6. Precopula in representative superfamilies of gammaridean Amphipoda.
(after Bousfield & Shih 1994)

male and employ the gnathopods mainly in agonistic manner to ward off competing males.

(2) non-mate-guarding, in which the mature male simply seeks out females wherever they may be at the time of ovulation. These males are classified as (a) pelagic searchers if the female is in the water column, or (b) benthic searchers if the female is on or in the bottom substrata. In either case the gnathopods are little or not sexually dimorphic, and no pre-amplexus takes place.

Both strategies are determined by the period of ovulation of the female, at which time the male must be present if fertilization of the eggs is to take place. For a short period immediately following moulting, the cuticle of the female is sufficiently flexible to allow for release of the eggs into the brood pouch or marsupium. Sperm is deposited there by the male during copulation, and fertilization of the eggs can then take place.

Conlan (1991) concluded that the searching strategy is a primitive, and mate-guarding an advanced, form of reproductive behaviour in amphipods. This conclusion provides the principal basis for the present updated semi-phyletic classification of amphipod superfamilies (Table I, p. 67).

In these mating strategies, the reproductive morphology of the mature female is seldom significantly different from that of the vegetative or feeding stages, except in some species of *Melita* and some aquatic talitroideans where the coxae are modified to accept the dactyl of the precopulatory gnathopod of the male. However, the breeding frequency and fecundity reflect overall differences in mating strategy. Thus, females of mate guarders tend to be iteroparous, with several broods in a lifetime, whereas non-mate-guarders tend to be semelparous, with only one brood in a lifetime.

In the most primitive superfamily groups within Natantia, contact between the mate-seeking male and the female takes place only during actual copulation, and its duration is brief (Conlan 1991). These positions have been illustrated for a number of representative families and superfamilies of both Natantia and Reptantia. (Bousfield & Shih 1994). The positions vary according to the relative size of males and females, and on environmental conditions. All ensure rapid sperm transfer at the time of the female's ovulation moult.

Some pre-amplexing positions are illustrated in Fig. 6. Preamplexing is rare within superfamilies of Natantia, and where it does occur briefly, differs little from that of amplexus. Within Reptantia, however, pre-amplexus is nearly the rule. In the primitive Gammarioidea, males of Anisogammaridae (e.g., *Eogammarus*

oclaini, Fig. 6E) grasp the smaller female by the base of coxa 4, usually by means of gnathopod 1. In family Gammaridae (e.g., *Gammarus*, Fig. 6F), the male carries the female by means of a "fore-and aft" clutching of the anterior edge of peraeon plate 1 and posterior edge of peraeon 5, facilitated by the very oblique palm of gnathopod 1. Within the Hadzioidea, the male of *Melita nitida* (Fig. 6D) employs his small gnathopod 1 to grasp the female by the specially modified anterior lobe of coxa 6. His much enlarged gnathopod 2 may be used in fending off competing males. In many aquatic Talitroidea, especially in *Hyalella* and *Allorchestes* (Hyalellidae, Fig. 6C) and in *Hyale* and *Parallorchestes* (Hyalidae, Fig. 6B), the dorsally positioned male inserts the dactyl of gnathopod 1 in a precopulatory notch in the lower anterior margin of peraeon 2 of the smaller female. Again, the much enlarged gnathopod 2 apparently functions agonistically towards other males. In some species of *Hyale*, however, the dactyl of gnathopod 2 may be used in grasping and/or rotating the female.

The widespread phenomenon of convergent evolution of high-level characters states is well illustrated by these superficially similar mating strategies, that differ morphologically and tactically at family and subfamily levels.

The Phylogenetic Tree.

Possible natural relationships among subordinal and superfamily groups may be represented in the form of a phylogenetic tree (Fig. 7). This dendrogram is modified from Bousfield & Shih (1994) to include superfamilies Iphimedioidea Lowry and Myers, 2000 and Stenothoidea Bousfield, 2000, and reflect the influence of additional characters and character states. The plesiomorphic character states, especially of the antennal sensory organelles, are most strongly evinced in taxa, extant or extinct, that are closest to the trunk and main branches. The apomorphic or advanced and specialized features are best developed in taxa placed near the branching extremities. The phylogenetic "tree" may be viewed, in effect, as a form of cladogram in which the character states are ordered and arranged "parsimoniously", but without numerical basis.

The present version is little changed from the earlier tree (1994). During the past 10 years the number of species in each group has increased, variously, by only about 5-10%, few major new taxa have been discovered, and the ordering of character states has remained basically unchanged. However, as noted above (Fig. 4) the form of the rami of uropods 1 & 2 have here been

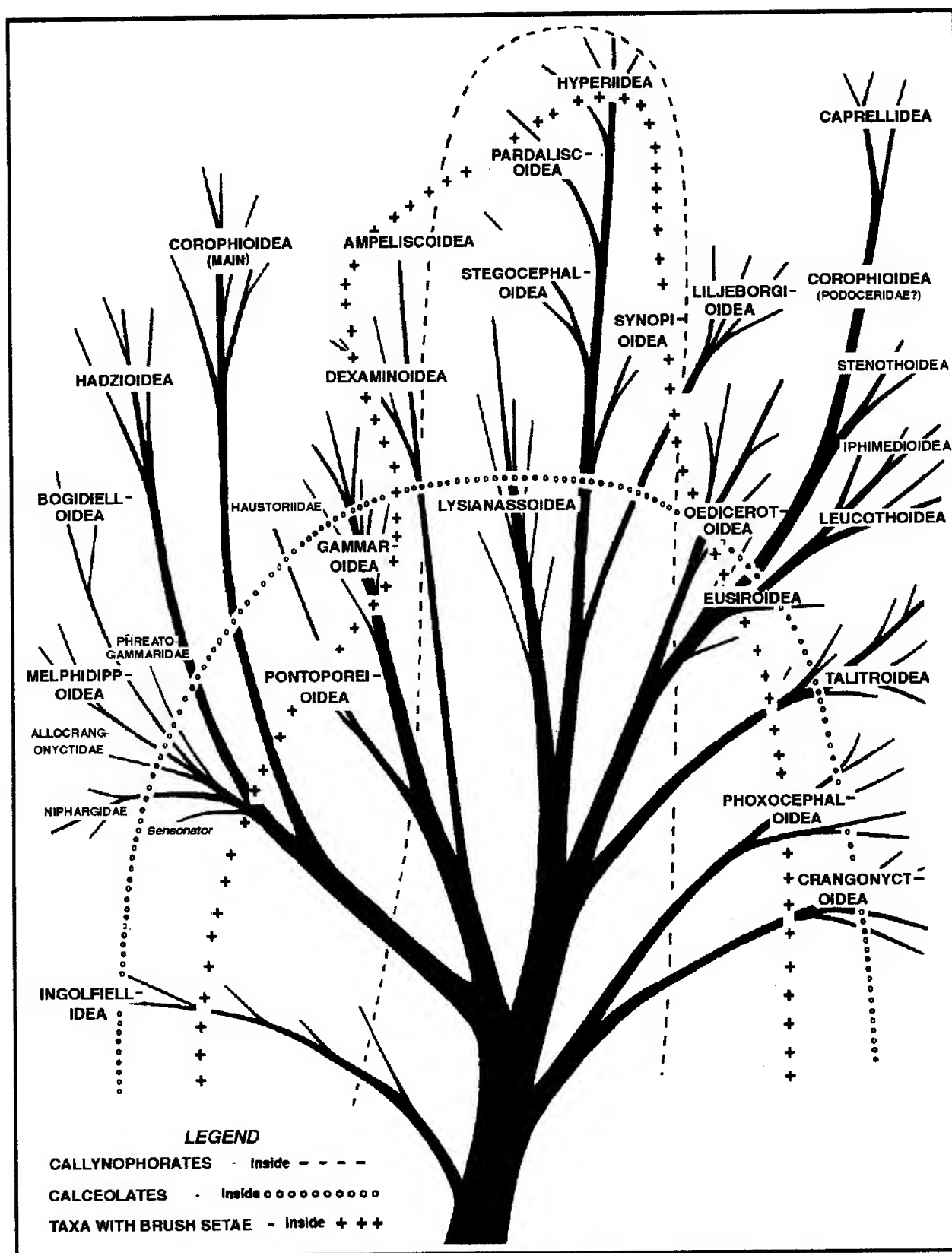


Fig. 7. Phylogenetic tree of suggested natural relationships within suborders and superfamilies of the Amphipoda (modified from Bousfield & Shih 1994).

suggested as significant indicators of phyletic relationships. The degree of anterolobation of coxae 5 & 6, and of heteropody of pereopods 5-7, deserve further study as indicators of phyletic significance. Emphasis on such parameters has here altered the position of the main trunk which now centrally subtends superfamilies of Natantia leading to the Hyperiidea, the most highly modified (advanced) of fully natatory taxa.

The phyletic position of the Liljeborgioidea, a group not yet rigorously defined, remains uncertain. North American family inclusions (p.100) are mainly benthic, commensal, deep-demersal, or hypogean in fresh water. Antennal reproductive sensory organelles are lacking in all subgroups, and most have developed sexually dimorphic gnathopods and pre-amplexing mating behaviour. Paradoxically it seems, component families retain lanceolate or transitional type uropod rami, posterolobate or weakly anterolobate coxae 5 & 6, and pereopods 5-7 are basically homopodous. Other enigmatic family- or perhaps superfamily-level groups elsewhere include the Niphargidae, Phreatogammaridae, and the monotypic *Sensonator valentienensis* Notenboom, 1986.

In phylogenetic analysis of the 10 suborders of the Isopoda, Brusca & Wilson (1991) have employed cladistic methodology leading to major classificatory recommendations. However, the universal applicability and adequacy of cladistic analyses for this purpose has been questioned by some (e.g., Gosliner & Ghiseln 1984). Relative to the taxonomically "difficult" order Amphipoda, the superficially similar peracaridan order Isopoda is more uniformly benthic in life style, with much greater development of both external and internal parasitic forms. It is palaeohistorically more ancient (Bousfield & Conlan 1990), and thus with perhaps fewer "intermediate" stages that frustrate creation of neatly defined phyletic units based on one or two character states only.

A full cladistic analysis of the Amphipoda is beyond the scope of this paper. Serious problems concerning character state homoplasy, and the status of so-called "intermediate" taxa have yet to be resolved (e.g., in Berge et al 2001). However, a phyletic tree based on "first principles" here provides a useful visual basis for eventual numerical establishment of a true phyletic classification of the Amphipoda.

PHYLETIC ARRANGEMENT OF HIGHER TAXA

The present phyletic classification of higher amphipod taxa (Table I) is based on relatively few characters and character states, most of which exhibit

high classificatory value. The North American species list (Appendix I, p. 75) follows this arrangement of higher taxonomic names.

The present analysis recognizes the Ingolfiellidea and Gammaridea as distinct and valid subordinal divisions of Order Amphipoda. However, the Hyperiidea and Caprellidea are of lesser significance, here submergerd within subcategories of Natantia and Reptantia, respectively. This conclusion agrees in part with the results of a limited cladistic analysis of the Amphipoda by Berge et al (2001). That study likewise combines hyperiids and caprellids variously within the Gammaridea, but is less demonstrative of the subordinal distinctness of the Ingolfiellidea.

Within suborder Gammaridea, the pragmatic terms "Natantia" and "Reptantia" continue to encompass almost the same superfamily groups as earlier proposed (Bousfield & Shih 1994). Introduction of the form of the rami of uropods 1 & 2 as primary phyletic indicators reinforces the applicability of those subcategories, at least on a semi-phyletic basis. Thus, the newly proposed uropod-descriptive terms "Lanceolata" and "Lineata", are essentially interchangeable with the original terms "Natantia" and "Reptantia", since they encompass virtually the same respective superfamily groups.

Two major subgroups may be recognized within the Natantia: the primary Lanceolata, and the transitional Lanceolata. Member of the former are typically fully marine, have a mainly free-swimming life style, their antennal sensory organelles are well-developed, but the gnathopods are not sexually dimorphic. The "Transitionals" are not strictly marine, exhibit a wider variety of benthonic (commensal) life styles, and exhibit varying loss of antennal organelles, but corresponding development of sexually dimorphic, preamplexing gnathopods.

The Reptantia may be subdivided into: (1) primitive superfamilies having posterolobate coxae 5 & 6, and (2) advanced superfamilies in which these coxae are mainly anterolobate. The more primitive "anterolobates" encompass the pontoporeioidean and gammaroidean superfamilies ("gammarida" of Barnard & Barnard 1983). The advanced "anterolobates" contain the most highly evolved groups of gammaridean amphipods, marked by very specialized morphologies and life styles.

As noted above, the position of the Liljeborgioidea remains enigmatic. In conspicuous morphological character states and life style, component members seem clearly assignable to the "Reptantia". However, the condition of the posterior pereopods and uropod

rami is plesiomorphic and characteristic of most "Natantia". A tentative, but not entirely satisfactory solution is to place the Liljeborgioidea among the "Advanced Transitionals" within Natantia (Table I).

In early phyletic studies (e.g., Bousfield 1979, 1983), the author utilized several other external morphological features, some of which tend to support the present categories. Thus, members of the Natantia usually possess a distinct rostrum, coxal gill on peraeopod 7, well-developed natatory uropod 3, but relatively short antenna 1; in the Reptantia, however, the rostrum, and coxal gill of peraeopod 7 are usually lacking, uropod 3 is often reduced and non-natatory, and antenna 1 is usually elongate.

Sternal gills, of various form and presumed osmoregulatory function, occur only in freshwater taxa, but may have phyletic significance nonetheless. Thus, within Natantia, all superfamilies that encompass freshwater families and genera contain some species bearing sternal gills (e.g., in *Gammaracanthus*, *Pseudamoera*, and *Falklandella* within Eusiroidea; *Paracalliope* within Oedicerotoidea; *Phreatogammarus* within Melphidippoidea; and *Paracrangonyx* within Liljeborgioidea). In the Reptantia, however, sternal gills are characteristic of the more primitive superfamilies Crangonyctoidea (all families), Talitroidea (Hyalellidae), and Pontoporeioidea (*Monoporeia*, *Diporeia*). Sternal gills are lacking in all freshwater gammaroideans and hadzioideans (e.g., weckeliids, pseudoniphargids), to which may be added the European-Mediterranean regional species of Niphargidae, *Sensonator*, and all members of superfamily Bogidielloidea.

Attempts at utilizing other seemingly phyletically promising characters and states have proven frustrating and ineffective, largely because of homoplasious character state similarities at superfamily level. Mouthpart morphology tends to reflect feeding style and is thus useful mainly in family level classification [e.g., in Stegocephalidae (Berge 2000)]. Seemingly "in defiance of" other phyletic trends across both Natantia and Reptantia, the morphology of female brood lamellae varies between the broad, marginally setose, presumed plesiomorphic condition, and the narrow, strap-like, apomorphic form.

A very few characters have been little utilized to date, and may merit further investigation. Pleopod morphology is seldom figured or described in detail, especially in the early literature. What little is known of their character states (e.g., type of retinacula, "clothespin spines") tends to be conservative "across the taxo-

nomic board". Small morphological differences may therefore be significant at high classificatory level. Presence or absence and size of the accessory flagellum seems not phyletically accountable; its length appears secondarily increased in some deepwater gammarids of Lake Baikal. However, its position of origin (anterior in some Phoxocephalidae and Liljeborgiidae, mediolateral in nearly all other taxa) merits further study. Character states of surface ultrastructure are little known but may be especially promising as phyletic indicators when the difficulties of terminology and function have been resolved (Halcrow & Bousfield 1987).

CONCLUSIONS

Analysis of plesio-apomorphic conditions of selected external morphological characters and reproductive behaviour has resulted in a revised classification of the amphipod Crustacea. Introduction of new characters has lent support to recognition of only two suborders, the primitive Ingolfiellidea, and the more advanced and much more diverse Gammaridea. The analysis also lends further support to the phyletic significance of previous gammaridean subcategories "Natantia" and "Reptantia", interchangeable with newly proposed terms "Lanceolata" and "Lineata" respectively. These basic gammaridean morphotypes are presented in Fig. 8 as an assist to visualizing or conceptualizing morphological relationships among the species of North American amphipods (Appendix I).

Because of homoplasious occurrence of some character states "across the taxonomic board", these subcategory names combine elements of phyletic significance with pragmatic usefulness. Cognizance of such variation within all component species requires that superfamilies be realistically diagnosed by a "best-fit" consensus of character states, rather than by rigorous conformity to one or two morphological criteria.

The classification outlined in Table I may be used as a form of "key" to subordinal and superfamily groups listed in Appendix 1. This extensive list of marine, brackish, freshwater and terrestrial species contains all known suborders and superfamilies, and many of the families allocated to each superfamily (see Martin & Davis 2001).

Phyletic classification has many advantages, not the least of which is conformity with phyletic classifications elsewhere within Class Crustacea, and major ordinal groups within the Animal Kingdom. Superfamily grouping of the North American fauna (Appendix I) has also facilitated comparative biogeogeographical

TABLE I. Phyletic Classification of the Amphipoda suggested by character states of the uropods superimposed on those of reproductive morphology and behaviour, and other characters.

- I. AMPHIPODA INGOLFIELLIDEA** (uropod 2 > 1; eyes stalked; maxillipeds partly separated basally; peduncle 3 of antenna 2 elongate, body vermiform; 2 families - hypogean, marine and freshwater).
- II. AMPHIPODA GAMMARIDEA** (uropod 1 > 2; eyes sessile; maxillipeds fused basally; peduncle 3 of antenna 2 not elongate; ~150 families - epigean and hypogean, marine, freshwater, and terrestrial).
 - A. LANCEOLATA (=NATANTIA)** (rami of both uropods 1 & 2 lanceolate, often with serially arranged marginal spines and lacking apical spines; antennae strongly sexually dimorphic, male with sensory antennalorganelles; gnathopods not (or weakly) sexually dimorphic; uropod 3 usually large, biramous).
 - I. Basic Lanceolates** (uropods 1 & 2 rami lanceolate; gnathopods not sexually dimorphic).
 - 1. Callynophorates** (with antennal callynophore and brush setae in male)
 - Lysianassoidea (antennae calceolate, head not rostrate)
 - Pardaliscoidea; Stegocephaloidea: Hyperiidea (non-calceolate; head rostrate)
 - Hyperiidea (maxilliped lacking palp; coxae 1-4 small; A2 short in female)
 - Synopioidea (callynophore weak or non-existent, but brush setae present);
 - 2. Phoxocephaloideans** (callynophore seldom and brush setae infrequent; calceoli plesiomorphic, receptacle and bulla lacking, body with few distal elements; head strongly rostrate; pereopod 5 dactylate); 5 families, fossorial, marine, mainly antiboreal).
 - II. Transitionals** (uropods 1 & 2 transitional in form; callynophore & brush setae reduced or lacking; gnathopods weakly sexually dimorphic, or not).
 - 3. Primitive Transitionals** (antennae often calceolate, coxae 5 & 6 posterolobate)
 - Eusiroidea (mostly pelagic; pereopods 5-7 homopodous, segment 4 produced behind)
 - Oedicerotoidea (fossorial; pereopods 5 & 6 homopodous, P7 elongate; gnathopods sexually dimorphic in 2 families).
 - Leucothoidea (benthonic) (uropod 3, outer ramus 1-segmented; gnathopod rarely sex. dimorph.)
 - Iphimedioidea (benthonic): uropod 3, outer ramus 1-segmented, gnathopods weak not dimorph).
 - Stenothoidea (benthonic), uropod 3, outer ramus 2-segmented; gnathopod often sex. dimorphic)
 - 4 Advanced Transitionals** (male antennae non-calceolate, with brush setae, callynophore rare; coxae 5 & 6 anterolobate, uropod 3 biramous, often natatory)
 - Dexaminoidea and Ampeliscoidea (uropod 2 & 3 fused; U3 rami large, natatory)
 - Melphidippoidea: (uropod 2 & 3 separate; U3 lanceolate, weakly sexually dimorphic)
 - Liljeborgioidea (gnathopods sexually dimorphic; life style commensal or freshwater hypogean.
 - B. LINEATA (=REPTANTIA)** (uropod rami linear, with apical spines, lateral marginal spines irregular; gnathopods sexually dimorphic, usually strongly; usually benthic reproductive behaviour)
 - I. Posterolobate reptants** (Coxae 5 & 6 posterolobate; uropod 3 short, rami reduced)
 - Crangonyctoidea (Antenna 1 elongate, with accessory flagellum; A2 calceolate in male);
 - Talitroidea (Antenna 1 the shorter, lacking accessory flagellum; A2 non-calceolate)
 - II. Anterolobate Reptants** (Coxae 5 & 6 anterolobate; uropod 3, one or both rami large)
 - 1. Primitive Anterolobates** (telson bilobate; free-swimming, free-burrowing, or commensal)
 - Pontoporeioideans (appendages fossorial, P5 adactylate; gnathopods weakly or not sexually dimorphic; may retain pelagic reproduction, with primitively calceolate antenna 2 (male)
 - Gammaroideans (appendages seldom fossorial; gnathopods subsimilar in size and sexually dimorphic; antennae weakly or not calceolate, coxal gill on pereopod 7; mainly freshwater)
 - Hadzioideans (appendages rarely fossorial; antennae not calceolate; gnathopods unlike and strongly sexually dimorphic; antennae not calceolate; P7 lacking coxal gill; marine and brackish)
 - 2. Advanced Anterolobates** (telson plate-like or entire; domicolous or excl. hypogean life style)
 - Bogidielloideans (vermiform; uropod 3 subequally biramous; telson plate-like; f.w. hypogean).
 - Corophioideans (body depressed; pereopods 3 & 4 glandular; uropod 3 reduced, telson fleshy. animals marine, domicolous (tube-buidling); male gnathopods mate guarding).
 - Caprellideans (body slender, cylindrical; coxae lacking; abdomen vestigial; marine, epigean, semi-sessile; 2 infrorders: Caprellida (skeleton shrimps) and Cyamida (whale lice).

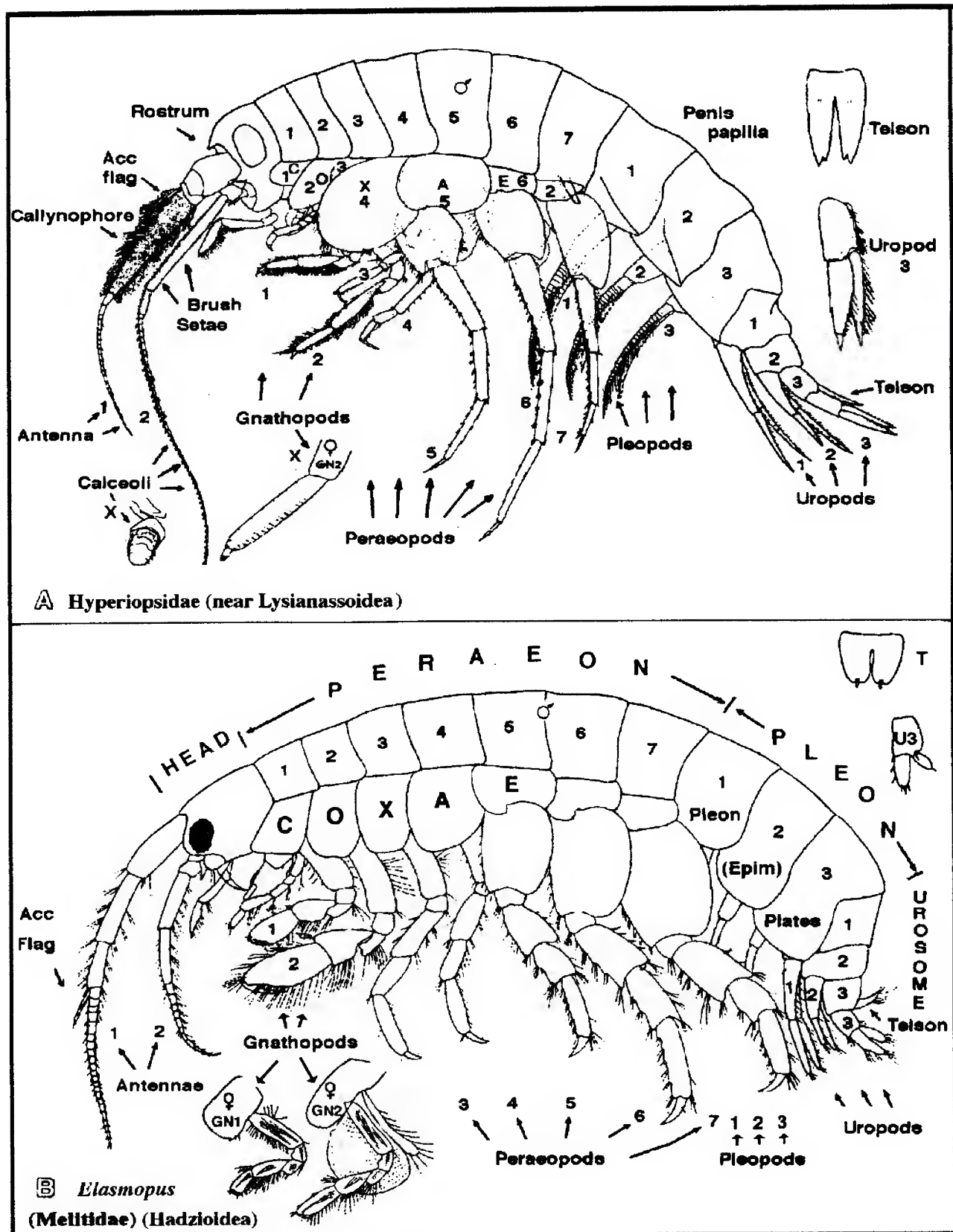


Fig. 8. Representative morphotypes of basic categories of phyletic classification of the Amphipoda
 A. Lanceolata (=Natantia). B. Lineata (=Reptantia) (after Bousfield & Shih 1994).

analysis of subregional faunas (Bousfield 2001). In summary, Arctic and Pacific coastal marine amphipod faunas are relatively primitive, possibly reflecting the long-term (biohistorical) stability of those regions. The east coast faunas are more advanced, compare phylogenetically with those of the Mediterranean region, and presumably reflect the relatively recent origin of the North Atlantic Ocean (since late Jurassic). Gulf coast amphipods encompass the highest percentage of advanced, and lowest percentage of primitive superfamilies, consistent with its relatively high year-round temperature regime. Thus, within the Amphipoda, evolution of apomorphic features (e.g., sexually dimorphic gnathopods) "classically" proceeds most rapidly in tropical regions; conversely, plesiomorphic features (e.g., antennal sensory organelles) are most frequently retained in cold-water regions and in the deep sea where evolutionary rates are presumably much slower. This biogeographic-phyletic analytical methodology has been extrapolated from North American superfamily groups to other well-studied regional faunas to conclude that the world's most primitive marine assemblages presently occur in the Antarctic.

The North American freshwater amphipod fauna is much more diverse than was believed during the mid 1900's, thanks mainly to the extensive recent work of Dr. John R. Holsinger and colleagues, with much new material yet to be published (per. commun.). It contains a high percentage of ancient relict types with sternal gills, dominated in hypogean habitats by members of the Crangonyctoidea, and in epigean habitats by the exclusively neotropical Hyalellidae (Bousfield 1996) and the arctic-boreal pontoporeioidean genus *Diporeia* (Bousfield 1987). The more modern gammaroideans and hadzioideans, lacking sternal gills, are widely diverse throughout Eurasia. In North America, however, these advanced groups are represented only peripherally, and by small numbers of species and few families, of which some are recently introduced (e.g., Witt et al. 1997). A few relict species within Gammaracanthidae, Sebidae, and Bogidiellidae complete the North American freshwater complex.

The need for full return to phyletic classification of the Amphipoda, inevitable though it may be, remains urgent. Present analysis indicates that a fully satisfactory phyletic classification still eludes us. Cladistic methodology (e.g., Berge et al. 2001) has not yet solved the problem of suitable outgroups and/or homoplasious occurrence of character states widely across the taxonomic board. The problem may yet be solved through pooling of results from all analytical methodology, and

employment of some of the characters and character states here developed. Especially promising is genetic methodology, both DNA hybridization and rDNA sequencing (Schram, Duffy, pers. commun.). Although these methodologies have special limitations of their own, they seem minimally affected by homoplasy of external character states, thereby providing a more reliable basis for phyletic classification. The present arrangement of superfamilies is not fully phyletic and is far from a final answer. It is proposed as a potentially useful platform upon which may be reconstructed a probable pathway of morphological evolution within the amphipod crustaceans.

SELECTED REFERENCES (include those of the main text, and references to taxa of the Appendix that were published mainly post-coverage of Barnard & Barnard (1983) and Barnard & Karaman (1991), up to and including 1999, and some post-1999.

- Baldinger, A.J., W. D. Shepard, & D. L. Threlhoff 2000. Two new species of *Hyalella* (Crustacea: Amphipoda: Hyalellidae) from Death Valley National Park, California, U.S.A. *Proc. Biol. Soc. Washington* **113** (2): 443-457.
- Barnard, J. L. 1958. Index to families, genera, and species of the gammaridean Amphipoda (Crustacea). Occas. Pap. Allan Hancock Foundation. **19**: 1-145.
- Barnard, J. L. 1969. The families and genera of marine gammaridean Amphipoda. *Bull. U. S. Nat'l. Museum* **271**: 534 pp., 173 Figs.
- Barnard, J. L. 1973. Revision of Corophiidae and Related Families (Amphipoda). *Smiths. Contr. Zool.* **151**: 127, 1 fig.
- Barnard, J. L. & C. M. Barnard, 1983. *Freshwater Amphipoda of the world. Vols. I & II*. Hayfield Associates. Mt. Vernon, VA. 830 pp., 50 figs.
- Barnard, J. L., & M. M. Drummond 1982. Gammaridean Amphipoda of Australia. part V: superfamily Haustorioidea. *Smiths. Contr. Zool.* **360**: 1-148, 58 figs.
- Barnard, J. L. & C. Ingram 1990. Lysianassoid Amphipoda (Crustacea) from deep-sea thermal vents. *Smiths. Contr. Zool.* **499**: 1-80.
- Barnard, J. L., & G. S. Karaman, 1983. Australia as a major evolutionary centre for Amphipoda (Crustacea) *Proc. Int. Conf. Biol. and Evol. Crustacea, Austral. Mus., Sydney*: 45-61.
- Barnard, J. L., & G. S. Karaman, 1991. The families and genera of Marine Gammaridean Amphipoda (except Marine Gammaroids). *Rec. Austral. Mus.*

- Suppl. 13, Parts 1 & 2: 866 pp.
- Barnard, J. L. & J. D. Thomas, 1989a. Four species of Synopiidae from the Caribbean region (Crustacea: Amphipoda). *Proc. Biol. Soc. Wash.* **102**(2): 362-374.
- Barnard, J. L. & J. D. Thomas, 1989b. A new species *Ampelisca burkei* (Crustacea, Amphipoda) from Florida. *Proc. Biol. Soc. Wash.* **102** (2): 375-384.
- Berge, J., & W. Vader 1997. Stegocephalid (Crustacea, Amphipoda) species collected in the BIOFAR and BIOICE programmes. *Sarsia* **82**: 347-370.
- Berge, J., & W. Vader 2000. Revision of the stegocephalid genera *Phippsia* and *Tetradeion* (Crustacea: Amphipoda) with description of four new species. *Mem. Mus. Victoria* **58** (1): 149-178.
- Berge, J. & W. Vader 2000b. Revision and cladistic analysis of the amphipoda (Crustacea) Family Stegocephalidae. Tromsø Museum, MS.
- Berge, J., G. Boxshall, & W. Vader 2001(2000). Cladistic analysis of the Amphipoda. *Arch. Polske Hydrobiol.* **47**: 379-400.
- Borowsky, B. 1984. The use of the males' gnathopods during precopula in some gammaridean Amphipoda.. *Crustaceana* **47**(3): 245-250.
- Bousfield, E. L. 1973. Shallow-water gammaridean Amphipoda of New England. Cornell Univ. Press, Ithaca N.Y., 312 pp.
- Bousfield, E. L. 1977. A new look at the systematics of gammaroidean amphipods of the world. *Crustaceana*, Suppl. **4**: 282-316.
- Bousfield, E. L., 1979. A revised classification and phylogeny of the amphipod Crustacea.. *Trans. Roy. Soc. Canada* **4** (14): 343-390.
- Bousfield, E. L. 1980. Studies on the freshwater amphipod crustaceans of New Zealand and Tasmania *Proc Int. Conf. Biol. and Evol. Crustacea*, Austral. Mus., Sydney, May, 1980. Oral Pres. & Abstract.
- Bousfield, E. L., 1982a. Amphipoda: Gammaridea. pp. 254- 285. in *Synopsis and Classification of Living Organisms*. S. B. Parker (ed.). McGraw-Hill, New York, Vol. II.: 254-285; 293-294.
- Bousfield, E. L. 1982b. Amphipoda: Palaeohistory. In *McGraw-Hill Yearbook of Science and Technology for 1982-1983*: 96-100.
- Bousfield, E. L., 1983. An updated phyletic classification and palaeohistory of the Amphipoda. *Crustacean Issues*. A. A. Balkema, Rotterdam. **1**: 257-278.
- Bousfield, E. L. 1984. Recent advances in the systematics and biogeography of landhoppers Amphipoda: Talitridae) of the Indo-Pacific region. pp. 171-210. In: F. J. Radovsky, P. H. Raven, & S. H. Sohmmer (eds.). *Proc. Symp. Pacif. Biogeogr.*, Bishop Mus., Honolulu, May 26, 1982: 171-210.
- Bousfield, E. L. 1987a. Amphipod parasites of fishes of Canada. *Can. Bull. Fish. & Aqu. Sci.*, **217**: 1-37.
- Bousfield, E. L. 1987b. Revised morphological relationships within the amphipod genera *Pontoporeia* and *Gammaracanthus* and the "glacial relict" significance of their post-glacial distribution. *Can. J. Fish. Aquat. Sci.* **46** (10): 1714-1725.
- Bousfield, E. L. 1990a. A new genus and species of Hadzioidean amphipod crustacean from anchialine pools in Hawaii. *Beaufortia* **41** (4): 25-30, 1 fig.
- Bousfield, E. L. 1990b. Morphological convergence in free-burrowing amphipods and its significance in phyletic classification. *Proc. 5th Amphipod Colloquium*, Darling Marine Center, Walpole, Maine, Sept., 1989. 1 p. (Abstract of oral presentation).
- Bousfield, E. L. 1991. New sandhoppers (Crustacea: Amphipoda) from the Gulf coast of the United States. *Gulf Res. Repts*, Vol. **8** (3): 271-283, 7 figs.
- Bousfield, E. L. 1992. New sandhoppers (Crustacea: Amphipoda) from the Gulf coast of the United States. *Gulf Res. Reports* **8** (3): 271-283, 7 figs.
- Bousfield, E. L. 1996. A contribution to the reclassification of Neotropical freshwater hyalellid amphipods (Crustacea: Gammaridea, Talitroidea). *Boll. Mus. civ. St. nat. Verona* **20**: 175-224, 17 figs.
- Bousfield, E. L. 2000a. An updated commentary on the phyletic classification of amphipod crustaceans. Tenth International Colloquium on Amphipoda, Heraklion, Greece. April 16-21, 2000. Abstract.
- Bousfield, E. L. 2001a. The genus *Anisogammarus* (Gammaroidea: Anisogammaridae) on the Pacific coast of North America. *Amphipacifica* **3**(1): 29-47.
- Bousfield, E. L. 2001c. Biogeographical analysis of gammaridean amphipod faunas based on their phyletic classification. *Arch. Polske Hdrobiol.* **47** (3-4): 335-352.
- Bousfield, E. L., & A. Chevrier 1996. The amphipod family Oedicerotidae on the Pacific coast of North America. The *Monoculodes* and *Synchelidium* generic complexes: Systematics and distributional ecology. *Amphipacifica* **2** (2): 75-148, 42 figs. .
- Bousfield, E. L., & K. E. Conlan 1990. Malacostraca. In: *Green et al: Crustacea. Encyclopaedia Britannica. Macropaedia*, 1990: 854-859.
- Bousfield, E. L., & R. W. Heard 1986. Systematics, distributional ecology, and some host-parasite relationships of *Uhlorchestia uhleri* (Shoemaker) and *U. spartinophila*, new species (Crustacea: Amphi-

- poda) endemic to salt marshes of the Atlantic coast of North America. *J. Crust. Biol.* **6** (2): 264-274.
- Bousfield, E.L., & Hendrycks, E. A. 1994a. A revision of the family Pleustidae (Crustacea: Amphipoda: Leucothoidea). Systematics and biogeography of component subfamilies. Part I. *Amphipacifica* **1**(1): 17-58.
- Bousfield, E. L., & E. A. Hendrycks 1994b. The amphipod superfamily Leucothoidea on the Pacific coast of North America. Family Pleustidae: subfamily Pleustinae. Systematics and biogeography. *Amphipacifica* **1** (2): 3-69.
- Bousfield, E.L., & Hendrycks, E. A. 1995a. The amphipod superfamily Eusiroidea in the North American Pacific region. Family Eusiridae: systematics & distributional ecology. *Amphipacifica* **1** (4): 3-60.
- Bousfield, E. L., & E. A. Hendrycks, 1995b. The amphipod family Pleustidae on the Pacific coast of North America. Part III. Subfamilies Parapleustinae, Dactylopleustinae and Pleusirinae. Systematics and distributional ecology. *Amphipacifica* **2**(1): 65-133.
- Bousfield, E. L., & E. A. Hendrycks, 1997. The amphipod superfamily Eusiroidea on the Pacific coast of North America. Family Calliopidae. Systematics and distributional ecology. *Amphipacifica* **2** (3): 3-66.
- Bousfield, E. L., & J. R. Holsinger 1989. A new crangonyctid amphipod crustacean from hypogean fresh waters of Oregon. *Can. J. Zool.* **67**: 963-968.
- Bousfield, E. L., & P. M. Hoover, 1995. The amphipod superfamily Pontoreioidea on the Pacific coast of North America. II. Family Haustoriidae. Genus *Eohaustorius* J.L. Barnard. Systematics and distributional ecology. *Amphipacifica* **2** (1): 35-64.
- Bousfield, E. L., & P. M. Hoover, 1997. The amphipod family Corophiidae on the Pacific coast of North America. Part V. Corophiinae, new subfamily. Systematics & distributional ecology. *Amphipacifica* **2** (3): 67-139.
- Bousfield, E. L., & Z. Kabata 1987. Amphipoda. Pp. 149-163. In: L. Margolis & Z. Kabata (eds.). Guide to the Parasites of Fishes of Canada. *Can. Spec. Publ. Fish. Aquat. Sci.* **101**: 184 pp.
- Bousfield, E. L., & J. A. Kendall 1994. The amphipod superfamily Dexaminioidea on the North American Pacific coast. Families Atylidae and Dexaminidae: Systematics and distributional ecology. *Amphipacifica* **1** (3): 3-67.
- Bousfield, E. L., & H. Morino 1992. The amphipod genus *Ramellogammarus* in fresh waters of western North America: Systematics and distributional ecology. *Contr. Nat. Sci., Roy. Brit. Col. Mus.* **17**: 1-22, 13 figs.
- Bousfield, E. L., & Shih, C.-t., 1994. The phyletic classification of amphipod crustaceans: problems in resolution. *Amphipacifica* **1** (3): 76-134.
- Bousfield, E. L., & C. P. Staude, 1994. The impact of J. L. Barnard on North American Pacific amphipod research. *Amphipacifica* **1** (1): 3-16.
- Bowman, T. E., & H. E. Gruner, 1973. The Families and Genera of Hyperioidea. *Smiths. Contr. Zool.* **146**: 1-64, 81 figs.
- Brunel, P., L. Bosse, & G. Lamarche, 1998. Catalogue of the Marine Invertebrates of the Estuary and Gulf of St. Lawrence (English title). *Can. Spec. Publ., Fish. Aquat. Sci.*, No. **126**: 405 pp.
- Brusca, R. C., & G. D. F. Wilson 1991. A phylogenetic analysis of the Isopoda with some classificatory recommendations. *Mem. Queensland Mus.* **31**: 143-204.
- Bulycheva, A. I. 1957. Morski blochi morei SSSR i sopredel'nykh vod (Amphipoda: Talitroidea). *Akad. Nauk SSSR. Opred. Faune SSSR* **65**: 1-185.
- Cadien, D. B., & J. W. Martin, 1999. *Myzotarsa anaxiphilus*, new genus, new species, an atylopsine amphipod (Gammaridea: Pleustidae) commensal with lithodid crabs in California. *J. Crust. Biol.* **19** (3): 593-611.
- Camp, D. 1998. Checklist of the shallow-water marine Malacostraca of Florida. pp. 123-189. In *Florida Mar. Res. Inst. Tech. Rept. TR-3*: 1-238.
- Chevrier, A., P. Brunel, & D. J. Wildish 1991. Structure of a suprabenthic shelf sub-community of gammaridean Amphipoda in the Bay of Fundy compared with similar sub-communities in the Gulf of St. Lawrence. in *Proc. VIIIth Internat. Colloquium on Amphipoda*, Walpole, Maine, Sept., 1989., ed. L. Watling. *Hydrobiologia*, **223**: 81-104, fig. 1-6.
- Conlan, K. E. 1990. Revision of the crustacean amphipod genus *Jassa* Leach (Corophioidea: Ischyroceridae). *Can. J. Zool.* **68** (10): 2031-2075, figs. 1-29.
- Conlan, K. E. 1991. Precopulatory mating behaviour and sexual dimorphism in the amphipod Crustacea. *Hydrobiologia* **223**: 255-282.
- Conlan, K. E., 1994. New species of amphipod crustaceans of the genera *Photis* and *Gammaropsis* (Corophioidea: Isaeidae) from California. *Amphipacifica* **1** (3): 67-73, 3 figs.
- Conlan, K. E., & J. R. Chess 1992. Phylogeny and ecology of a new kelp-boring amphipod, *Peramphithoe stypotrupetes*, new species (Corophioidea: Ampithoidae). *J. Crust. Biol.* **12**: 410-422.

- Coyle, K. O., & R. C. Highsmith 1989. Arctic amphipods, three new species. *J. Crust. Biol.* **9**: 157-175.
- Dadswell, M. J. 1974. Distribution, ecology, and post-glacial dispersal of certain crustaceans and fishes in eastern North America. *Natl. Mus. Nat. Sci., Publ. Zool.* **11**: 1-110, figs. 1-17, pl. I.
- Dalkey, A., 1998. A new species of amphipod (Crustacea: Amphipoda: Lysianassoidea) from the Pacific coast of North America. *Proc. Biol. Soc. Washington* **11** (3): 621-626.
- Dojiri, M., & J. Sieg 1987. *Ingolfiella fuscina*, new species (Crustacea: Amphipoda) from the Gulf of Mexico and the Atlantic coast of North America, and partial redescription of *I. atlantisi* Mills, 1967. *Proc. Biol. Soc. Washington* **100** (3): 494-505.
- Dunbar, M. J. 1954. The amphipod Crustacea of Ungava Bay, Canadian Eastern Arctic. *J. Fish. Res. Bd. Canada* **11** (6): 700-798, 42 figs.
- Foster, J. M., & S. E. LeCroy 1991. *Haustorius jayneae*, a new species of haustoriid amphipod from the northern Gulf of Mexico with notes on its ecology at Panama City Beach, Florida, USA. *Gulf Res. Repts.*, **8** (3): 259-270.
- Godfrey, R. B., J. R. Holsinger, & K. A. Carson, 1988. Comparison of the morphology of calceoli in the freshwater amphipods *Crangonyx richmondensis* sens. lat. (Crangonyctidae) and *Gammarus minus* (Gammaridae). *Crustaceana, Suppl.* **13**: 115-121.
- Gosliner, T. M., & M. T. Ghiselin 1984. Parallel evolution in opisthobranch gastropods and its implication for phylogenetic methods. *Syst. Zool.* **33** (3): 255-274.
- Gurjanova, E. F. 1951. *Bokoplavy morei SSSR i sopredel'nykh vod* (Amphipoda-Gammaridea). *Akad. Nauk SSSR, Opred. po Faune SSSR* **41**: 1029 pp., 705 figs.
- Halcrow, K., & Bousfield, E. L. 1987. Scanning electron microscopy of surface microstructures of some gammaridean amphipod crustaceans. *J. Crust. Biol.* **7** (2): 274-287.
- Hendrick, W. B. 1964. Quantitative Characters in Computer Taxonomy. pp. 105-114. in Heywood & McNeill (eds.). *Phenetic and Phylogenetic Classification*. Systematics Assoc., London: 164 pp., 1964.
- Holsinger, J. R. 1989. Allocrangonyctidae and Pseudocrangonyctidae, two new families of Holarctic subterranean amphipod crustaceans (Gammaridea), with comments on their phylogenetic and zoogeographic relationships. *Proc. Biol. Soc. Wash.* **102**: 947-959.
- Holsinger, J. R. 1992a. Sternophysingidae, a new family of subterranean amphipods (Gammaridea: Crangonyctoidea) from South Africa, with description of *Sternophysinx calceola*, new species, and comments on phylogenetic and biogeographical relationships. *J. Crust. Biol.*, **12** (1): 111-124.
- Holsinger, J. R. 1992b. Four new species of subterranean amphipod crustaceans (Artesiidae, Hadziidae, Sebidae) from Texas, with comments on their phylogenetic and biogeographic relationships. *Texas Memorial Museum, Speleological Monographs*, **3**: 1-22.
- Holsinger, J. R. 1993 (1996). *Paramexiweckelia ruffoi*, a new species of subterranean amphipod crustacean (Hadziidae) from south-central Texas, with observations on phylogenetic and biogeographic relationships. *Boll. Mus. civ. St. nat. Verona*, **20**: 89-103.
- Holsinger, J. R., & D. P. Shaw 1987. *Stygobromus quatsinensis*, a new amphipod crustacean from caves on Vancouver Island, British Columbia, with remarks on zoogeographical relationships. *Can. J. Zool.* **65**: 2202-2209.
- Hoover, P. M., & E. L. Bousfield 2001. The amphipod superfamily Leucothoidea on the Pacific coast of North America. Family Amphilocheidae: Systematics and distributional ecology. *Amphipacifica* **3** (1): 3-27, 10 figs.
- Ishimaru, S. 1994. A Catalogue of gammaridean and ingolfiellidean Amphipoda recorded from the vicinity of Japan. *Rept. Sado Mar. Biol. Sta.* No. **24**: 1-86.
- Ishimaru, S., 1997. Taxonomic review of the family Biancolinidae (Amphipoda: Gammaridea), with description of a new species from Japan. *J. Crust. Biol.* **16** (2): 395-405.
- Jarrett, N. E., & E. L. Bousfield 1994a. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part I. Metharpiniinae, new subfamily. *Amphipacifica* **1** (1): 58-140, 31 figs.
- Jarrett, N. E., & Bousfield, E. L. 1994b. The amphipod superfamily Phoxocephaloidea on the Pacific coast of North America. Family Phoxocephalidae. Part II. Subfamilies Pontharpiniinae, Partharpiniinae, Broginiinae, Phoxocephaliniinae and Harpiniinae. Systematics and distributional ecology. *Amphipacifica*, **1**(2): 71-150, 35 figs.
- Jarrett, N. E., & E. L. Bousfield 1996. The amphipod superfamily Hadziioidea on the Pacific coast of North America. Part 1. The *Melita* group: systematics and distributional ecology. *Amphipacifica* **2** (2): 3-74, 41 figs.
- Just, J. 1998. Siphonocetinae (Crustacea: Amphipoda: Ischyroceridae 7: Australian concholests, *Ambicholestes* n. gen., with a description of six new

- species and a new, restricted diagnosis for *Caribboectes* Just, 1983. Rec. Australian Mus. **50**(1): 27-54.
- Karaman, G. S. 1982. Contributions to the knowledge of the Amphipoda 127. New freshwater subterranean genus *Relictoseborgia*, n. gen. with remarks to genus *Seborgia* Bousfield (fam. Sebidae). Studia Marina, 11-12: 85-94.
- Krapp-Schickel, T., & N. E. Jarrett 2000. The amphipod family Melitidae on the Pacific coast of North America. Part II. The *Maera-Ceradocus* complex. Amphipacifica **2** (4): 23-61, 14 figs.
- Laubitz, D. R. 1993. Caprellidea (Crustacea: Amphipoda): towards a new synthesis. J. Nat. Hist. **27**: 965-976.
- LeCroy, S. E. 1995. Amphipod Crustacea III. Family Colomastigidae. Mem. Hourglass Cruises **9** (2): 1-139, 59 Figs.
- LeCroy, S.E. 2000. An Illustrated Identification guide to the nearshore marine and estuarine gammaridean Amphipoda of Florida.. Vol. 1. Families Gammaridae, Hadziidae, Isaeidae, Melitidae and Oedicerotidae. Fla. Dept. Envir. Protection., Tallahassee: 1-195.
- Lincoln, R. J. 1979. British Marine Amphipoda: Gammaridea. British Museum (Nat. Hist), London: 658 pp.
- Lincoln, R. J. & D. E. Hurley 1981. The calceolus, a sensory structure of gammaridean amphipods. Bull. Brit. Mus. (Nat. Hist.) **40**: 103-116.
- Lincoln, R. J., & J. K. Lowry 1984. The amphipod calceolus as an indicator of phyletic affinity. Amphipod Phyletic Classification Workshop. Nat'l. Mus. Nat. Sci., Ottawa, August, 1984. Oral Presentation & Abstract.
- Linnaeus C. 1758. Systema Naturae. Editio Decima, Tomus I. Holmiae (Stockholm): Laurentii Salvii.
- Lowry, J. K. 1986. The callynophore, a eucaridan/peracaridan sensory organ prevalent among the Amphipoda (Crustacea). Zool. Scr. **15** (4): 333-349.
- Lowry, J. K., & H. E. Stoddart, 1992. A revision of the genus *Ichnopus* (Crustacea: Amphipoda: Lysianassoidea: Uristidae). Rec. Australian Mus. **44** (2): 185-244.
- Lowry, J. K., & H. E. Stoddart 1995. The Amphipoda (Crustacea) of Madang Lagoon: Lysianassidae, Opisidae, Uristidae, Wandinidae, and Stegocephalidae. pp. 97-174 in J. K. Lowry, ed. Amphipoda (Crustacea) of the Madang Lagoon, Papua, New Guinea. Rec. Austral. Mus., Suppl. **22**.
- Lowry, J. K., & H. E. Stoddart 1997. Amphipod Crustacea IV. Families Aristiidae, Cyphocarididae, Endevouridae, Lysianassidae, Scopelocheiridae, Uristidae. Mem. Hourglass Cruises. **X**, Part I. 1-148, 63 figs.
- Lowry, J. K., & A. A. Myers 2000. A family level phylogeny of iphimedioid amphipods (Crustacea, Amphipoda). Tenth Int. Colloqu. Amphipoda. Heraklion, Greece, April 16-21, 2000: Abstract.
- Macdonald, K.S. III. 1999. Molecular phylogeny of Lake Baikal amphipods. M.S. Thesis. College of William and Mary, Williamsburg, Virginia, USA.
- Margolis, L., T. E. McDonald & E.L. Bousfield 2000. The whale-lice (Amphipoda: Cyamidae) of the northeastern Pacific region. Amphipacifica **2** (4): 63-117.
- Martin, J. W., and G. E. Davis. In press (2001). An Updated Classification of the Recent Crustacea. Science Series, Natural History Museum of Los Angeles County.
- Moore, P. G. 1992. A study on amphipods from the superfamily Stegocephaloidea Dana 1852 from the northeastern Pacific region: systematics and distributional ecology. J. Nat. Hist. **26**: 905-936.
- Myers, A. A., 1988. A cladistic and biogeographic analysis of the Aorinae, subfamily nov. Crustaceana, Suppl. **13**: 167-192.
- Notenboom, J., 1986. *Sensorator valentiensis*, n.g., n. sp., (Amphipoda), from different biotopes in southern Valencia. Bidj. Dierk. **56** (1): 60-74.
- Ortiz, M., 1991. Amphipod Crustacea II. Family Bateidae. Mem. Hourglass Cruises **8** (1): 1-31, 5 figs.
- Ortiz, M., & R. R. Lalana, 1993. Adicion a la lista de especies y bibliografia de los anfipodos (Crustacea: Amphipoda) del Mediterraneo Americano. Rev. Invertebr. Mar. **14** (1): 16-37.
- Ortiz, M., & R. R. Lalana 1994. Two new species of the genus *Elasmopus* (Amphipoda: Gammaridea) from Cuban marine waters. Trav. Mus. Hist. Nat. "Grigore Antipa" **34**: 293-302.
- Ortiz, M., & R. R. Lalana, 1996. Los Anfipodos de la Primera Expedicion conjunta Cuba-USA a bordo B/I "Ulises", a las aguas del archipelago Sabana-Camaguey, Cuba, en 1994. Anales Inst. Biol. Univ. Nac. Auton. Mexico. Ser. Zool. **67** (1): 89-101, 78 figs.
- Rakocinski, C. F., R.W. Heard, S.E. LeCroy, J.A. McLelland, and T. Simons, 1993. Seaward change and zonation of the sandy-shore macrofauna at Perdido Key, Florida, U.S.A. Estuarine, Coastal and Shelf Science **36**: 81-104.
- Rakocinski, C. F., et al., 1996. Responses by macro-

- benthic assemblages to extensive beach restoration at Perdido Key, Florida, U.S.A. *Journal of Coastal Research* 12(1): 326-353.
- Read, A. T., and D. D. Williams 1990. The role of the calceoli in precopulatory behaviour and mate recognition of *Gammarus pseudolimnaeus* Bousfield (Crustacea, Amphipoda). *J. Nat. Hist.* 24: 351-359.
- Riley, M., 1983. The explanation of organic diversity. Clarendon Press, Oxford: 1-265.
- Ruffo, S.(ed). 1982, 1988, 1993, 1998. The amphipoda of the Mediterranean. Parts 1-4. Mem. Inst. Oceanographique. Prince Albert Foundation, Monaco.
- Sars, G. O., 1895. An Account of the Crustacea of Norway with short descriptions and figures of all the species. Christiania and Copenhagen. Vol I. Amphipoda. pp. i-viii, 1-711, pls. 1-240, 8 suppl. pls.
- Schram, F. S., 1986. Crustacea. Oxford Press, New York: 606 pp.
- Schram, F. 2000. Genes, form, and evolution. Tenth Intern. Colloqu. Amphipoda, Heraklion, Greece, Apr. 16-21. Abstract.
- Sedlak-Weinstein, E. 1992. A new species of *Isocyamus* (Amphipoda: Cyamidae) from *Kogia breviceps* (De Blainville, 1838) in Australian Waters. *Syst. Parasit.* 23 (1): 1-6.
- Serejo, C. S. 2000. A preliminary cladistic analysis of the superfamily Talitroidea (Amphipoda: Gammaridea): Tenth Intern. Colloqu. Amphipoda, Heraklion, Greece, April 16-21, 2000. Abstract.
- Shaw, D. P., 1989. New amphipods from geothermal vent sites off the west coast of Vancouver island, British Columbia, with an appraisal of the amphipod family Sebidae. *Can. J. Zool.* 67: 1882-1890.
- Shih, C.-t. 1991. Description of two new species of *Phronima* Latreille, 1802 (Amphipoda: Hyperiidea) with a key to all species of the genus. *J. Crust. Biol.* 11 (2): 322-335.
- Shih, C.-t., & E. A. Hendrycks 1996. *Proscina vinogradovi*, new species, and *Cheloscina antennula*, new genus, new species (Amphipoda: Hyperiidea: Proscinidae) from the eastern North Pacific. *J. Crust. Biol.* 16: 591-601.
- Shoemaker, C. R. 1930. The Amphipoda of the Cheticamp Expedition of 1917. *Contr. Can. Biol. Fish.*, n.s. 5 (10): 221-359, 54 figs.
- Stapleton, J. L., W. D. Williams, & J. L. Barnard, 1988. The morphology of the calceolus of an Australian crangonyctoid freshwater amphipod. *Crustaceana* 55: 157-162, 1988.
- Staude, C. P., 1995. The amphipod genus *Paramoera* Miers (Gammaridea: Eusiroidea: Pontogeneiidae) *Amphipacifica* 1 (4): 61-102, 8 figs.
- Stebbing, T.R.R., 1906. Amphipoda I. Gammaridea. *Das Tierreich*: 1-806, figs. 1-127.
- Steele, D. E., 1988a. Some evolutionary trends in the Amphipoda. *Proc. VI Int. Colloquium Amphipod Crustacea. Crustaceana, Suppl. 13. Studies on Amphipoda*: 107-121.
- Steele, D. E., 1988b. What is the amphipod lifestyle? *Crustaceana, Suppl. 13. Studies on Amphipoda*: 134-142.
- Steele, D. E., & V. Steele 1993. Presence of two types of calceolus in *Gammarellus angulosus* (Amphipoda: Gammaridea). *J. Crust. Biol.* 13(3): 538-543.
- Stock, J. S., 1977. The Zoogeography of the crustacean suborder Ingolfiellidea with description of new West Indian taxa. *Stud. Fauna Curacao*. 55: 121-146.
- Sweet, M. 1996. The evolution of the Haustorioidea of the world, and post-embryonic development, taxonomy and ecology of the Haustoriidae (Amphipoda: Crustacea). PhD dissertation. Texas A & M.
- Takeuchi, I. 1993. Is the Caprellidea a monophyletic group? *J. Nat. Hist.* 27: 947-964.
- Thomas, J. D. 1997. Systematics, ecology, and phylogeny of the Anamixidae (Crustacea: Amphipoda). *Rec. Australian Mus.* 49 (1): 35-98.
- Thomas, J. D., & J. L. Barnard 1988. *Elasmopus balkomanus*, a new species from the Florida Keys (Crustacea: Amphipoda). *Proc. Biol. Soc. Wash.* 101 (4): 838-842.
- Thomas, J. D., & J. L. Barnard 1991a. A review of the genus *Iphimedia* (Crustacea: Amphipoda) with descriptions of three new species from Australia, Papua, New Guinea, and Florida. *Invert. Taxonomy* 5: 469-485.
- Thomas, J. D., and J. L. Barnard 1991b. *Photis trapheris*, a new elephantine species from the Caribbean Sea (Crustacea: Amphipoda). *Proc. Biol. Soc. Wash.* 104 (1): 96-100.
- Thomas, J. D., & J. L. Barnard, 1991c. Two new species of *Netamelita* from the Caribbean Sea (Crustacea: Amphipoda: Gammaridea). *Proc. Biol. Soc. Wash.* 104 (3): 583-592.
- Thomas, J. D., & J. L. Barnard 1992a. *Podocerus cheloniphilus*, a testudinous amphipod newly recorded from the western Atlantic Ocean. *Bull. Mar. Sci.* 50 (1): 108-116.
- Thomas, J. D., & J. L. Barnard 1992b. *Podocerus kleidus*, new species from the Florida Keys. (Crustacea: Amphipoda, Dulichiidae). *Bull. Mar. Sci.* 51 (3): 309-314.

Williams, W. D., & J. L. Barnard 1988. The taxonomy of crangonyctoid Amphipoda (Crustacea) from Australian freshwaters. *Rec. Austral. Mus., Suppl.* **10**: 1-180.

Witt, J. D. S., P. D. N. Hebert, & W. B. Morton, 1997. *Echinogammarus ischnus*: another crustacean invader in the Laurentian Great Lakes Basin. *Can. J. Fish. Aquat. Sci.* **54**: 264-268.

APPENDIX I.

PHYLETIC LIST OF AMPHIPOD CRUSTACEA OF NORTH AMERICA, NORTH OF MEXICO.

The study of phyletic classification presented in the main text was developed mainly through analysis of North American species listed here. The North American amphipod fauna contains about 1650 species, representative of all known suborders and superfamilies, about 2/3 of families, and perhaps 1/4 of the total number of species world-wide. As noted in the acknowledgements (p. 50), the list was developed, over a 15-year period, by a subcommittee of the Committee on Scientific and Common Names of Aquatic Invertebrates, chaired by Dr. Donna D. Turgeon, NOAA, Washington, D. C. The list encompasses marine, brackish, freshwater and terrestrial faunal components. An additional ~200 species have been recognized from continental North America north of Mexico, including Canada and Alaska, but not Greenland, Bermuda, or the Bahamas. Others are known from the U. S. mid-Pacific state of Hawaii. These undescribed taxa are in the process of being treated by systematic specialists. Their work will be added to an updated final list, including common names where possible, to be published in a special volume on the Crustacea of North America jointly sponsored by NOAA and the American Fisheries Society.

The system of higher classification of amphipods of this list is essentially phyletic, including superfamily level taxa, following standards proposed for Ingolfiellidea by Stock (1977), Hyperiidea by Bowman & Gruner (1973); Caprellidea by Laubitz (1993) and Gammaridea by Schram (1986), updated by Bousfield and Shih (1994) and Bousfield (2000).

Although the arrangement of superfamilies follows that of Table I of the main text (p. 67), the component families and genera are listed alphabetically. Newly proposed subordinal categories of classification are omitted for the present, but if reasonably widely accepted by colleagues, may be introduced in the final CNAI crustacean volume. The former subordinal-level names Hyperiidea and Caprellidea are retained *in situ* within the list, mainly for pragmatic reasons, even though they have been merged within suborder Gammaridea. The merged older names have yet to be reassessed at suitable classificatory levels.

As noted above, the phyletically arranged list of North American amphipods provides a basis for biogeographical analysis of its subregional marine and freshwater faunas. This study, currently in press (Bousfield 2001b), also contains a detailed numerical analysis of numbers of species by subregion, superfamily, and family level categories.

Occurrence Legend

A	-	Arctic	LA	-	Louisiana
AC	-	Acadian	LABR	-	Labrador
At	-	Atlantic	MI	-	Mississippi
AL	-	Alaska	N	-	Northern
ALEUT	-	Aleutians	NC	-	North Carolina
BAR	-	Pt. Barrow	NFLD	-	Newfoundland
BC	-	British Columbia	P	-	Pacific
BER	-	Bering Sea	ORE	-	Oregon
C	-	Carolinian	SE	-	Southeastern
CAL	-	California	ST L	-	St. Lawrence Gulf
CHES	-	Chesapeake Bay	V	-	Virginian
CUBA	-	Cuba	WA	-	Washington State
E	-	Eastern	FW	-	Freshwater
FL	-	Florida	ST	-	Semiterrestrial
G	-	Gulf of Mexico	T	-	Terrestrial
HAT	-	Cape Hatteras	TEX	-	Texas
HAW	-	Hawaii	W	-	Western
			YUC	-	Yucatan

SCIENTIFIC NAME

OCCURRENCE

SUBORDER INGOLFIELLIDEA HANSEN, 1903**Family Ingolfiellidae Hansen, 1903***Ingolfiella fuscina* Dojiri & Sieg, 1987

At-G (SC-W FL)

SUBORDER GAMMARIDEA LATREILLE, 1803**Superfamily Lysianassoidea (Bousfield, 1979; Lowry & Stoddart, 1997)****Family Lysianassidae Dana, 1849****Subfamily Lysianassinae Dana, 1849**

<i>Acidostoma laticorne</i> G. O. Sars, 1879	At (N, slope)
<i>Aruga oculata</i> Holmes, 1908	P (CAL)
<i>A. holmesi</i> (Barnard, 1955)	P (WA-CAL), G (W FL)
<i>Bonassa bonairensis</i> (Stephensen, 1933)	G (FL)
<i>Concarnes concavus</i> (Shoemaker, 1933)	G (FL)
<i>Dissiminassa homosassa</i> Lowry & Stoddart, 1997	G (FL)
<i>D. dissimilis</i> (Stout, 1913)	P (S CAL)
<i>Eclecticus eclecticus</i> Lowry & Stoddart, 1997	G(FL)
<i>Lysianopsis alba</i> Holmes, 1903	At (V-C), G (FL)
<i>L. cubensis</i> Shoemaker, 1933	G (FL.)
<i>L. hummelincki</i> (Stephensen, 1933)	G (FL)
<i>L. ozona</i> Lowry & Stoddart, 1997	G (W FL)
<i>L. subantarctica</i> (Schellenberg, 1931)	G (Fl-tropic?)
<i>Macronassa macromera</i> (Shoemaker, 1916)	P (S CAL)
<i>M. pariter</i> (J. L. Barnard, 1969)	P (CAL)
<i>Menigrates obtusifrons</i> (Boeck, 1861)	At (G, N, slope)
<i>Shoemakerella cubensis</i> (Stebbing, 1897)	G (W FL)
<i>S. nasuta</i> (Dana, 1853)	G (FL) (see Shoemaker, 1948)

Subfamily Tryphosinae Lowry & Stoddart, 1997

<i>Allogaussia recondita</i> Stasek, 1958	P (BC-CAL)
<i>Hippomedon coecus</i> (Holmes, 1908)	P (S CAL)
<i>H. columbianus</i> Jarrett & Bousfield, 1982	P (BC-ORE)
<i>H. denticulatus</i> (Bate 1857)	At (N, slope)
<i>H. granulatus</i> Bulycheva, 1955	P (BER-BC)
<i>H. holbolli</i> (Kroyer, 1946)	At (ST L)
<i>H. pensacola</i> Lowry & Stoddart, 1997	G (W FL)
<i>H. propinquus</i> Sars, 1890	At (ST. L-HAT)
<i>H. serratus</i> Holmes, 1905	At (AC-CHES)
<i>H. subrobustus</i> Hurley, 1963	P (CAL?)
<i>H. tenax</i> Barnard, 1966	P (S CAL?)
<i>H. tricatrix</i> Barnard, 1971	P (ORE, deep)
<i>H. zetismus</i> Hurley, 1963	P (CAL, deep)
<i>Koroga megalops</i> Holmes, 1908	P (BC-WA, offshore)

<i>Lepidepecrella charno</i> Barnard, 1966	P (CAL-deep?)
<i>Lepidepecreoides nubifer</i> Barnard, 1971	P (ORE-deep)
<i>Lepidepecreum eoum</i> Gurjanova, 1951	P (BER-CAL)
<i>L. nubifer</i> Barnard, 1971	P (ORE, deep)
<i>L. garthi</i> Hurley, 1963	P (BC-CAL)
<i>L. gurjanovae</i> Hurley, 1963	P (BC-CAL)
<i>L. serraculum</i> Dalkey, 1998	P ((CAL)
<i>L. serratum</i> Stephensen, 1925	At (G, N, slope)
<i>Orchomenella decipiens</i> Hurley, 1963	P (CAL)
<i>O. holmesi</i> (Hurley, 1963)	P (BC-CAL)
<i>Orchomenella minuta</i> (Kroyer, 1846)	P (AL-ORE)-A-At (ST L)
<i>O. pacifica</i> (Gurjanova, 1951)	P (BER-CAL)
<i>O. perdido</i> Lowry & Stoddart, 1997	G (W F)
<i>O. thomasi</i> Lowry & Stoddart, 1997	G (W FL)
<i>Orchomene depressa</i> Shoemaker, 1930	At (AC, shelf)
<i>O. holmesi</i> (Hurley, 1963)	P (CAL)
<i>O. limodes</i> Meador & Present, 1985	P (CAL)
<i>O. macroserrata</i> Shoemaker, 1930	At (AC, shelf)
<i>O. magdalensis</i> (Shoemaker, 1942)	P (S CAL?)
<i>O. nugax</i> (Holmes, 1904)	P (BER-WA)
<i>O. obtusa</i> (Sars, 1891)	P (SE AL-CAL), At (ST L)
<i>O. pectinata</i> Sars, 1882	At (ST L)
<i>O. serrata</i> (Boeck, 1861)	At (AC-V)
<i>Paralibrotus setosus</i> Stephensen, 1923	At (ST L, slope)
<i>Paratryphosites abyssi</i> (Goes, 1866)	A-At (G-BCN)
<i>Psammonyx longimerus</i> Jarrett & Bousfield, 1982	P (BC-ORE)
<i>P. nobilis</i> (Stimpson, 1853)	At (AC-DEL)
<i>P. terranova</i> Steele, 1979	At (AC-NFLD)
<i>Rimakoroga floridiana</i> Lowry & Stoddart, 1997	G (W FL)
<i>R. rima</i> (J. L. Barnard, 1964)	P (S CAL)
<i>Schisturella pulchra</i> (Hansen, 1887)	At ST L slope)
<i>Tmetonyx cicada</i> (Fabricius, 1780)	At (ST L -AC)
<i>T. gulosus</i> (Kroyer, 1845)	At (ST L)
<i>Tryphosella apalachicola</i> Lowry & Stoddart, 1997	G (W FL)
<i>T. compressa</i> (Sars, 1891)	At (ST L slope)
<i>T. groenlandica</i> (Hansen, 1887)	At (ST L slope)
<i>T. gulosus</i> (Kroyer, 1845)	At (N, slope)
<i>T. index</i> (Barnard, 1966)	P (CAL)
<i>T. metacaecula</i> Barnard, 1967	P (CAL)
<i>T. nanoides</i> (G. O. Sars, 1895)	At (St.L)
<i>T. orchomenoides</i> Stephensen, 1925	A-At
<i>T. rotundata</i> (Stephensen, 1923)	At (ST L, slope)
<i>T. spitzbergensis</i> (Chevreux, 1926)	A-At (ST L, slope)
<i>T. triangula</i> (Stephensen, 1925)	At (ST L)
<i>Wecomodon wecomus</i> (Barnard, 1971)	P (SE AL-ORE)
<i>W. similis</i> Jarrett & Bousfield, 1982	P (BER-SE AL)
<i>W. wirketis</i> (Gurjanova, 1962)	P (BER-AL)

Family Uristidae Hurley, 1963

<i>Anonyx adoxus</i> Hurley, 1963	P (ORE-CAL)
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A.	<i>barrowensis</i> Steele, 1882	P-A (BAR)
A.	<i>beringi</i> Steele, 1982	P (BER)
A.	<i>comecrudus</i> J. L. Barnard, 1971	P (ORE)
A.	<i>compactus</i> Gurjanova, 1962	P (BER?), At (ST L)
A.	<i>dalli</i> Steele, 1983	P (BER?)
A.	<i>debruyni</i> Hoek, 1882	At (ST L)
A.	<i>epistomaticus</i> Kudrjaschov, 1965	P (BER?)
A.	<i>filiger</i> Stimpson, 1864	P (WA?)
A.	<i>hurleyi</i> Steele, 1986	P (AL?)
A.	<i>laticoxae</i> Gurjanova, 1962	P (BER?)
A.	<i>lilljeborgi</i> Boeck, 1871	P (AL-CAL)-A-At (AC)
A.	<i>makarovi</i> Gurjanova, 1962	P (BER)A-At (ST L)
A.	<i>m. nugax</i> (HYBRID, Brunel MS))	At (ST L)
A	<i>nugax</i> (Phipps, 1774)	P (BER-CAL?)-A-At
A.	<i>ochoticus</i> Gurjanova, 1962	P (BER?)-A-At
A.	<i>pacificus</i> Gurjanova, 1962	P (AL-WA)
A.	<i>petersoni</i> Steele, 1986	P (BER?)
A.	<i>schefferi</i> Steele, 1986	P (AL?)
A.	<i>sculptifer</i> Gurjanova, 1982	P (BER?)
A.	<i>shoemakeri</i> Steele, 1983	P (BER?)
	<i>Centromedon pavor</i> Barnard, 1966	P (ORE-CAL)
C.	<i>pumilus</i> (Liljeborg, 1865)	At (ST L)
	<i>Euonyx laquaeus</i> Barnard, 1967	P (deep)
	<i>Gronella groenlandica</i> (Hansen, 1887)	At (ST L)
	<i>Hirondellea fidenter</i> Barnard, 1966	P (CAL)?
	<i>Kyska dalli</i> Shoemaker, 1964	P (ALEUT)
	<i>Onisimus (Onisimus) litoralis</i> (Kroyer, 1845)	A-At (N)
	<i>Onisimus (Boekosimus) edwardsi</i> (Kroyer, 1846)	At (G, N)
O. (B.)	<i>glacialis</i> (G. O. Sars, 1900)	At (G)
O. (B.)	<i>normani</i> (Sars, 1891)	At (ST L slope)
O. (B.)	<i>plautus</i> (Kroyer, 1845)	At (ST L slope)
	<i>Paronesimus barentsi</i> (Stebbing, 1894)	A-At (N, slope)
	<i>Paratryphosites abyssi</i> (Goes, 1866)	At (deep)
	<i>Schisturella cedrosiana</i> Barnard, 1967	P (CAL)
S	<i>cocula</i> Barnard, 1966	P (BC)
S.	<i>dorotheae</i> (Hurley, 1963)	P (CAL)
S.	<i>grabenis</i> Barnard, 1967	P (deep)
S.	<i>totorami</i> Barnard, 1967	P (CAL)
S.	<i>tracalero</i> (Barnard, 1966)	P (S CAL)
S.	<i>zopa</i> Barnard, 1966	P (S CAL)
	<i>Sophrusyne robertsoni</i> Stebbing & Robertson, 1891	P (CAL)
	<i>Stephonyx biscayensis</i> (Chevreux, 1908)	G (FL)
	<i>Uristes californicus</i> Hurley, 1963	P (CAL)
U.	<i>dawsoni</i> Hurley, 1963	P (CAL)
U.	<i>entalladurus</i> Barnard, 1963	P (CAL?)
U.	<i>perspinus</i> Barnard, 1967	P (ORE, deep)
U.	<i>umbonatus</i> (Sars, 1882)	At ST L slope)

Family Scopelocheiridae Lowry & Stoddart, 1997

Paracallisoma coecum (Holmes, 1908) P (AL-BC, offshore)

Family Trischizostomatidae Lilljeborg 1865

Trischizostoma sp. (Bousfield, 1987 proposed) P-At (AL-CAL, deep)

Family Opisidae Lowry & Stoddart, 1995

Opisa eschrichti Kroyer 1842 P (BC-CAL), At (AC)
O. tridentata Hurley, 1963 P (BC- CAL)
O. odontochela Bousfield, 1987 P (SE AL-BC)

Subfamily concept Conicostomatinae Lowry & Stoddart proposal; Barnard & Karaman 1991?

Acidostoma hancocki Hurley, 1963 P (BC-CAL)
A. obesum subsp. *ortum* J. L. Barnard, 1967 P (CAL, deep)
Ocosingo borlus Barnard, 1964 (= *Fresnillo* Barnard) P (BC-CAL)
Pachynus barnardi Hurley, 1963 P (WA-CAL)
Prachynella lodo Barnard, 1964 P (WA-CAL)
Socarnes hartmanae Hurley, 1963 P (CAL)
S. vahli (Kroyer, 1838) At (ST L, slope)
Socarnoides illudens Hurley, 1963 P (ORE-CAL)

Family Cyphocarididae Lowry & Stoddart, 1997

Cyclocaris guilelmi Chevreux, 1899 P (SCAL?)
Cyphocaris challenger Stebbing, 1880 P (AL-CAL)
C. faurei K. H. Barnard, 1918 P (S CAL?)
C. guilelmi Chevreux, 1899 P (AL-CAL)
C. richardi Chevreux, 1905 P (BC-CAL)
C. anonyx Boeck, 1871 P (BC, offshore)
C. tunicola Lowry & Stoddart, 1997 G (W FL)
Metacyphocaris helgae Tattersall, 1906 P (AL-CAL)

Family Aristiidae Lowry & Stoddart, 1997

Aristias captiva Lowry & Stoddart, 1997 G (W FL)
A. expers Barnard, 1967 P (CAL?)
A. pacificus Schellenberg, 1936 P (BC-WA)
A. topsenti Chevreux, 1900 At ST L, slope)
A. tumidus (Kroyer, 1846) P (WA), At (ST L, slope)
A. veleronis Hurley, 1963 P (BC-CAL)
Boca campi Lowry & Stoddart, 1997 G (W FL)
B. elvae Lowry & Stoddart, 1997 G (E & W FL)
B. megachela Lowry & Stoddart, 1997 G (W FL)

Family Endeavouridae Lowry & Stoddart, 1997

Ensayara entrichoma Gable & Lazo-Wasem, 1990 G (W FL)
E. ramonella Barnard, 1964 P (S CAL?)

Family Hyperiopidae Bovallius, 1886
(near Cyphocarididae Lowry & Stoddart?)

<i>Parargissa americana</i> Barnard, 1961	P (CAL, BC, deep)
<i>P. galatheae</i> Barnard, 1961	P (CAL?)

Family Valettiidae Stebbing, 1888

<i>Valettiopsis dentata</i> Holmes, 1908	P (BC-CAL, deep)
<i>Cedrosella fomes</i> (Barnard, 1967)	P (CAL?)

1. Incerta sedis

<i>Eurystheus grillus</i> Lichtenstein, 1882	P (abyssal)
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Superfamily Stegocephaloidea Bousfield, 1979

Family Stegocephalidae Dana, 1855

Subfamily Adanienixinae Berge, 2000

<i>Andaniexis abyssi</i> Boeck, 1871	P (deep), A-At (AC)
<i>A. elinae</i> Berge & Vader, 1997	A
<i>A. gracilis</i> Berge & Vader, 1997	A
<i>A. lupus</i> Berge & Vader, 1997	A
<i>Parandania boeckii</i> (Stebbing, 1888)	P (BC)
<i>Parandaniexis mirabilis</i> Schellenberg, 1929	P (BC?)

Subfamily Andaniopsinae Berge, 2000

<i>Andaniopsis nordlandica</i> (Boeck, 1871)	At (BF)
<i>Andanieopsis pectinata</i> (Sars, 1882)	A-At (NFLD)

Subfamily Stegocephalinae Berge, 2000

<i>Bousfieldia mammilidacta</i> (Moore, 1992)	P (BC)
<i>Gordania camoti</i> (Barnard, 1967)	P (CAL)
<i>Phippsia romeri</i> Schellenberg, 1925	A
<i>Pseudo viscaina</i> (Barnard, 1967)	P (CAL)
<i>Stegocephalexia penelope</i> Moore, 1992	P (BC)
<i>S. hancocki</i> (Hurley, 1956)	P (S CAL, deep)
<i>S. minima</i> (Stephensen, 1925)	A-At (NFLD)
<i>S. pajarella</i> (Barnard, 1967)	P (CAL)
<i>Stegocephalus ampulla</i> (Phipps, 1774)	A
<i>S. abyssicola</i> (Oldevig, 1959)	A
<i>S. inflatus</i> Kroyer, 1842	PA (BER)-A-At (ST L)
<i>S. cascadiensis</i> (Moore, 1992)	P (ORE, deep)
<i>S. similis</i> (Sars, 1895)	A

Superfamily Pardaliscoidea Bousfield, 1979**Family Pardaliscidae Boeck, 1871**

<i>Caleidoscopsis tikal</i> (J. L. Barnard, 1967)	P (CAL)
<i>Halice abyssi</i> Boeck, 1871	At (ST L)
<i>H. malygini</i> (Gurjanova, 1936)	A
<i>H. ulcisor</i> Barnard, 1971	P (ORE)
<i>Halicoides lolo</i> (Barnard, 1971)	P (ORE)
<i>H. synopiae</i> (Barnard, 1962)	P (ORE)
<i>H. tambella</i> (Barnard, 1961)	P (CAL)
<i>Pardaliscella symmetrica</i> Barnard, 1959	P (CAL)
<i>P. yaquina</i> Barnard, 1971	P (ORE)
<i>Pardaliscoides fictotelson</i> J. L. Barnard, 1966	P (CAL, deep)
<i>Parahalice mirabilis</i> Birstein & Vinogradov, 1962	P (abyssal)
<i>Rhynohalicella halona</i> (Barnard, 1971)	P (BC-CAL)
<i>Tosilus arroyo</i> Barnard, 1966	P (S CAL, deep)

Family Stilipedidae Holmes, 1908**Subfamily Stilipedinae Holmes, 1908 (revised Holman & Watling, 1983)**

<i>Stilipes distincta</i> Holmes, 1908	P (AL-CAL)
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Subfamily Astyrinae Pirlot, 1934 (revised Holman & Watling, 1983)

<i>Astyra abyssi</i> Boeck, 1871	At (ST L)
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Family Vitjazianidae Birstein & Vinogradov, 1955

<i>Vitjaziana gurjanovae</i> Birstein & Vinogradov, 1955	P (BER, deep)
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Family Vemanidae Bousfield 1979 (see Thurston, 1989)

<i>Vemana lemuresa</i> Barnard, 1967	P (B CAL, deep)
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Superfamily Synopioidea Bousfield, 1979**Family Synopiidae Dana, 1855**

<i>Bruzelia tuberculata</i> Sars, 1866	P (AL-CAL), A-At (ST L)
<i>B. inlex</i> Barnard, 1967	P (CAL)
<i>B. guayacura</i> Barnard, 1972	P (CAL?)
<i>B. ascua</i> Barnard 1966	P (CL, deep)
<i>Bruzeliopsis cuspidata</i> Barnard, 1962	P (CAL)
<i>B. turba</i> Barnard, 1964	P (CAL)
<i>Priscosyrrhoë priscis</i> (Barnard, 1967)	P (S CAL)
<i>Garosyrrhoë bigarra</i> (Barnard, 1962)	P (S CAL)
<i>G. cf. bigarra</i> (Barnard, 1962)	G (FL)
<i>G. laquei</i> Ortiz, 1985	G (FL - CUBA)
<i>Pseudotiron pervicax</i> Barnard, 1967	P (CAL)
<i>P. golens</i> Barnard, 1962	P (CAL)

<i>P. coas</i> Barnard, 1967	P (CAL)
<i>Synopia ultramarina</i> Dana, 1853	G (FL)
<i>S. scheeleana</i> Bovallius, 1886	G (SE FL)
<i>Syrrhoe crenulata</i> Goes, 1866	P (AL-CAL), A-At (ST L - AC)
<i>S. longifrons</i> Shoemaker, 1964	P (BC-CAL)
<i>S. oluta</i> Barnard, 1972	P (CAL)
<i>Syrrhoites columbiae</i> Barnard, 1972	P (ORE, deep)
<i>S. cohasseta</i> Barnard, 1967	P (CAL)
<i>S. dulcis</i> Barnard, 1967	P (CAL)
<i>S. lorida</i> Barnard, 1962	P (CAL)
<i>S. silex</i> Barnard, 1967	P (CAL)
<i>S. terceris</i> Barnard, 1964	P (CAL)
<i>S. trux</i> Barnard, 1967	P (CAL, deep?)
<i>Tiron biocellata</i> Barnard, 1962	P (BC-CAL)
<i>T. spiniferus</i> (Stimpson, 1854)	A-At (AC)
<i>Metatiron cf. bellairisi</i> (Just, 1981)	G (FL)
<i>M. triocellatus</i> (Goeke, 1985)	G (FL)
<i>M. tropakis</i> (Barnard, 1972)	P (CAL?), At (V-C) G (FL?)

Family Argissidae Walker, 1904

<i>Argissa hamatipes</i> (Norman, 1869)	P (BER-CAL), A-At (ST) G (NW FL)
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SUBORDER HYPERIIDAE MILNE EDWARDS, 1830

Infraorder Physosomata Pirlot, 1929

Superfamily Scinoidea Bowman & Gruner, 1973

Family Scinidae Stebbing, 1888

<i>Scina borealis</i> (G. O. Sars, 1882)	P (BER-CAL)-At
<i>S. crassicornis</i> (Fabricius, 1775)	P (ORE-CAL)
<i>S. nana</i> Wagler, 1926	P (CAL)
<i>S. ratrayi</i> Stebbing, 1895	P (BC-WA, slope)-At
<i>S. tullbergi</i> (Bovallius, 1885)	P (CAL)-At (G)
<i>Proscina vinogradovi</i> Shih & Hendrycks, 1996	P (AL) (54 40'N 155 10'W)
<i>Cheloscina antennula</i> Shih & Hendrycks, 1996	P (AL) (53 20'N 155 16'W)

Family Mimonectidae Bovallius, 1885

<i>Mimonectes sphaericus</i> Bovallius, 1885	P (BER)-A-At
<i>M. gaussi</i> Woltereck, 1904?	P (BC-WA)

Superfamily Lanceoloidea Bowman & Gruner, 1973

Family Lanceolidae Bovallius, 1887

<i>Scypholaneola aestiva</i> Stebbing, 1888	P (WA-CAL, deep)-At
<i>S. vanhoeffeni</i> Woltereck, 1909	P (BC-WA)

<i>Lanceola loveni</i> Bovallius, 1885	P (ORE, deep)-At
<i>L. serrata</i> Bovallius, 1885	P (CAL, deep)
<i>L. pacifica</i> Bowman 1973	P (BC-WA)
<i>L. sayana</i> Bovallius, 1885	P (BER)

Family Chuneolidae Woltereck, 1909

<i>Chuneola parasitica</i> Vinogradov, 1956	P (BER-W ALEUT)
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Infraorder Physocephalata Bowman & Gruner, 1973

Superfamily Vibilioidae Bowman & Gruner, 1973

Family Vibiliidae Dana, 1852

<i>Vibilia armata</i> Bovallius, 1887	P (ORE-CAL)
<i>V. australis</i> Stebbing, 1888	P (BC-WA)-At - G
<i>V. viatrix</i> Bovallius, 1887	P (CAL)
<i>V. gibbosa?</i> Bovallius 1887	P (CAL)

Family Cystosomatidae Willemoes-Suhm, 1875

<i>Cystosoma fabricii</i> Stebbing, 1888	P (BC-CAL)-At, deep
<i>C. pellucidus</i> (Willemoes-Suhm, 1873)	P (SE AL-CAL)-At

Family Paraphronimidae Bovallius, 1887

<i>Paraphronima crassipes</i> Claus, 1879	P (BER-CAL, slope)-At (G)
<i>P. gracilis</i> Claus, 1879	P (BC-WA, deep)-At (Gulf)

Superfamily Phronimoidea Bowman & Gruner, 1973

Family Phronimidae Dana, 1853

<i>Phronima atlantica</i> Guerin, 1836	P (BER-CAL)-At-G
<i>P. bowmani</i> Shih, 1991	P (CAL)
<i>P. dunbari</i> Shih, 1991	P (CAL)
<i>P. pacifica</i> Streets, 1877	At-G
<i>P. sedentaria</i> (Forsk., 1775)	P (BC-CAL)-At
<i>P. solitaria</i> Guerin, 1836	At-G
<i>P. stebbingi</i> Vosseler, 1900	At-G
<i>Phronimella elongata</i> (Claus, 1862)	P (ORE)-At-G

Family Dairellidae Bovallius, 1887

<i>Dairella californica</i> (Bovallius, 1885)	P (ORE-CAL, oceanic)
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Family Phrosinidae Dana, 1853 (=Anchylomeridae)

<i>Anchylomera blossevillei</i> Milne-Edwards, 1830	P (WA-CAL)-At-G
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Phrosina semilunata Risso, 1822
Primno abyssalis (Bowman, 1968)
P. brevidens Bowman, 1978
P. johnsoni Bowman, 1978
P. lateillei Stebbing, 1888

P (CAL)-At-G
P (BC-CAL)
G
At-G
P (CAL)

Family Hyperiidae Dana, 1852

Hyperia antarctica Spandl, 1927
H. bengalensis (Giles, 1887?)
H. galba (Montagu, 1813)
H. leptura Bowman, 1973
H. medusarum (O.F.Mueller, 1776)
H. spinigera Bovallius, 1889
Hyperietta stephensi Bowman 1973
H. vosseleri (Stebbing, 1904)
H. luzoni (Stebbing, 1888)
H. stebbingi Bowman, 1973
Hyperoche medusarum (Kroyer, 1842)
Hyperioides longipes Chevreux, 1900
Hyperionyx macrodactylus (Stephensen, 1924)
Iulopsis loveni Bovallius, 1887
Lestrignus bengalensis Giles, 1887
L. schizogeneios (Stebbing, 1888)
L. crucipes (Bovallius, 1889)
L. macrophthalmus (Vosseler, 1901)
L. latissimus (Bovallius, 1889)
L. shoemakeri Bowman, 1973
Parathemisto abyssorum Boeck, 1870
Phronimopsis spinifera Claus, 1879
Themistella fusca (Dana, 1853)
Themisto pacifica (Stebbing, 1888)
T. libellula Lichtenstein, 1822
T. quadrichaudii Guerin 1842

P (AL-CAL)
P (CAL)
P (BER)-A-At
P (CAL)
P (BER-CAL)-A-At
P (BC-CAL)-At
P (BC-CAL)-At(G)
P (CAL)-At (G)
P (CAL)-At-G
P (CAL)-At -G)
P-A-At
P (CAL)-At-G
At-G
At
At -G
P (CAL)-At-G
At-G
At-G
At-G
At-G
P (S CAL)
P (BER)-A-At, deep
At-G
At-G
P (BER-CAL)
P (BER)-A-At
A-At

Superfamily Lycaeopsoidea Bowman & Gruner, 1973

Family Lycaeopsidae Chevreux, 1913

Lycaeopsis themistoides Claus, 1879
L. zamboangae (Stebbing, 1888)

At-G
P (CAL)-At

Superfamily Platysceloidea Bowman & Gruner, 1973

Family Pronoidae Claus, 1879

Eupronoe armata Claus, 1879
E. minuta Claus, 1879
Paralycaea gracilis Claus, 1879
Sympronoe parva (Claus, 1879)

At-G
P (CAL)-At-GULF
P (CAL)-At-G
P (S CAL)-At-G

Family Anapronoidae Bowman & Grüner, 1973

Anapronoe reinhardti Stephensen, 1925 P (CAL)

Family Lycaeidae Claus, 1879

Lycaea pulex Marion, 1874 P (CAL)
L. vincenti Stebbing, 1888 At-G
L. bovallioides Stephensen, 1925 G
L. bovallii Chevreux, 1900 G
Brachyscelus cruscolum Bate, 1961 P (BC-CAL)-At?
B. globiceps (Claus, 1871) At (CUBA)?
B. rapax Claus, 1871 G

Family Oxycephalidae Bate, 1861

Oxycephalus clausi Bovallius, 1887 P (BC-CAL, deep)-At-G
O. piscator Milne Edwards, 1830 At-G
Cranocephalus scleroticus (Streets, 1878) At-G
Leptocotis tenuirostris (Claus, 1871) At-G
Rhabdosoma whitei Bate, 1862 At-G
Simorhynchotis antennarius Claus, 1871 G
Streetsia challengerii Stebbing, 1888 P (BC-CAL, slope)-At-G
S. mindanaonis (Stebbing, 1888) G
S. pronoides (Bovallius, 1887) P (CAL)

Family Platyscelidae Bate, 1862

Amphithyrus bispinosus Claus, 1879 G
A. sculpturatus Claus, 1879 At-G
Hemityphus rapax (Milne-Edwards, 1830) At-G
Paratyphis maculatus Claus, 1879 At-G
Platyscelus serratulus Stebbing 1888? P (S CAL)
P. ovoides (Claus, 1879) At-G
Tetrathyrus forcipatus Claus, 1879 At-G

Family Parascelidae Bovallius, 1887

Thyropus edwardsi (Claus, 1879) At-G
T. sphaeroma (Claus, 1879) At-G
T. typhoides (Claus, 1879) P (CAL)-G
Schizoscelus ornatus Claus, 1879 At-G

Superfamily Phoxocephaloidea Bousfield, 1979 [=Haustorioidea Barnard & Drummon, 1982 (part)]

Family Platyischnopidae Thomas & Barnard, 1983

<i>Eudevenopus honduranus</i> Thomas & Barnard, 1983	At (FL-SC), G
<i>E. metagracilis</i> (Barnard, 1964)	P (S CAL)
<i>Skaptopus brychius</i> Thomas & Barnard, 1983	At (V-C, slope), G
<i>Tiburonella viscana</i> (Barnard, 1969)	P (S CAL)

Family Urothoidae Bousfield, 1979

<i>Urothoe denticulata</i> Gurjanova, 1951	P (BER?)
<i>U. rotundifrons</i> Barnard, 1962	P (CAL)
<i>U. varvarini</i> Gurjanova, 1953	P (BC-CAL)

Family Phoxocephalidae G. O. Sars, 1895

Subfamily Metharpiniinae Jarrett & Bousfield, 1994a

<i>Grandifoxus aciculatus</i> Coyle, 1982	P (AL-BC)
<i>G. acanthinus</i> Coyle, 1982	P (AL)
<i>G. constantinus</i> Jarrett & Bousfield, 1994a	P (BER)
<i>G. dixonensis</i> Jarrett & Bousfield, 1994a	P (BC)
<i>G. grandis</i> (Stimpson, 1856)	P (BC-CAL)
<i>G. lindbergi</i> (Gurjanova, 1953)	P (BER-BC)
<i>G. longirostris</i> (Gurjanova, 1938)	P (BER-BC)
<i>G. nasutus</i> (Gurjanova, 1936)	P (AL)
<i>G. pseudonasutus</i> Jarrett & Bousfield, 1994a	P (ALEUT)
<i>G. vulpinus</i> Coyle, 1982	P (AL-BC)
<i>Beringiaphoxus beringianus</i> Jarrett & Bousfield, 1994a	P (BER)
<i>Majoxiphalus major</i> (Barnard, 1960)	P (SE AL-CAL)
<i>M. maximus</i> Jarrett & Bousfield, 1994a	P (AL-BC)
<i>Foxiphalus aleuti</i> (Barnard & Barnard, 1982)	P (AL)
<i>F. apache</i> Barnard & Barnard, 1982	P (S CAL)
<i>F. cognatus</i> (Barnard, 1960)	P (S CAL)
<i>F. falciformis</i> Jarrett & Bousfield, 1994a	P (BC-ORE)
<i>F. fucaximeus</i> Jarrett & Bousfield, 1994a	P (WA)
<i>F. golfensis</i> Barnard & Barnard, 1982	P (S CAL)
<i>F. obtusidens</i> (Alderman 1936)	P (ORE-CAL)
<i>F. secasius</i> Barnard & Barnard, 1982	P (S CAL)
<i>F. similis</i> (Barnard, 1960)	P (BC-CAL)
<i>F. slatteryi</i> Jarrett & Bousfield, 1994a	P (BER)
<i>F. xiximeus</i> Barnard & Barnard, 1982	P (BC-CAL)
<i>Metharpinia coronadoi</i> Barnard 1980	P (S CAL)
<i>M. floridana</i> (Shoemaker, 1933)	P (CAL?), G (FL)
<i>M. jonesi</i> (Barnard, 1963)	P (S CAL)
<i>Rhepoxynius abronius</i> (J. L. Barnard, 1960)	P (BC-CAL)
<i>R. barnardi</i> Jarrett & Bousfield, 1994a	P (BC-CAL)
<i>R. bicuspidatus</i> (Barnard, 1960)	P (BC-CAL)
<i>R. boreovariatus</i> Jarrett & Bousfield, 1994a	P (BC)
<i>R. daboius</i> (Barnard, 1960)	P (BC-CAL)

<i>R. fatigans</i> (Barnard, 1960)	P (BC-CAL)
<i>R. gemmatus</i> (Barnard, 1969)	P (S CAL)
<i>R. heterocuspoidatus</i> (Barnard, 1960)	P (S CAL)
<i>R. homocuspoidatus</i> (Barnard & Barnard, 1982)	P (S CAL)
<i>R. lucubrans</i> (Barnard, 1960)	P (S CAL)
<i>R. menziesi</i> (Barnard & Barnard, 1982)	P (S CAL)
<i>R. pallidus</i> (Barnard, 1960)	P (BC-CAL)
<i>R. stenodes</i> (Barnard, 1960)	P (S CAL)
<i>R. tridentatus</i> (Barnard, 1954)	P (ORE-CAL)
<i>R. variatus</i> (Barnard, 1960)	P (BC-CAL)
<i>R. vigitegus</i> (Barnard, 1971)	P (BC-ORE)
<i>R. epistomus</i> (Shoemaker, 1938)	At (V-C?) G (FL?)
<i>R. hudsoni</i> Barnard & Barnard, 1982	At (V-C) G (FL?)

Subfamily Pontharpiiniinae Barnard & Drummond, 1978

<i>Mandibulophoxus alaskensis</i> Jarrett & Bousfield, 1994b	P (AL-BC)
<i>M. gilesi</i> J. L. Barnard, 1957	P (BC-CAL)
<i>M. mayi</i> Jarrett & Bousfield, 1994b	P (SE AL-BC)

Subfamily Parharpiiniinae Barnard & Drummond, 1978

<i>Eyakia robusta</i> (Holmes, 1908)	P (SE AL-CAL)
<i>Eyakia</i> sp. 1 (= <i>E. robusta</i> Barnard & Barnard, 1981)	P (CAL)
<i>Eyakia calcarata</i> (Gurjanova, 1938)	P (CAL)

Subfamily Brolginae Barnard & Drummond, 1978

<i>Eobrolgus chumashi</i> Barnard & Barnard, 1981	P (AL-CAL)
<i>E. pontarpioides</i> Gurjanova, 1953	P (BER)
<i>E. spinosus</i> (Holmes, 1905)	P?-At(V), G (E FL?)
<i>Paraphoxus beringiensis</i> Jarrett & Bousfield, 1994b	P (BER)
<i>P. communis</i> Jarrett & Bousfield, 1994b	P (BC)
<i>P. gracilis</i> Jarrett & Bousfield, 1994b	P (BC-CAL)
<i>P. oculatus</i> Sars, 1879	At (ST L)
<i>P. pacificus</i> Jarrett & Bousfield, 1994b	P (BER-BC)
<i>P. rugosus</i> Jarrett & Bousfield, 1994b	P (BER)
<i>P. similis</i> Jarrett & Bousfield, 1994b	P (BC)
<i>P. simplex</i> Jarrett & Bousfield, 1994b	P (BER?)

Subfamily Phoxocephalinae Barnard & Drummond, 1978

<i>Cephalophoxoides homilis</i> (Barnard, 1960)	P (BC-CAL)
<i>Leptophoxus icelus</i> Barnard, 1960	P (CAL)
<i>Metaphoxus frequens</i> Barnard, 1960	P (SE AL-CAL)
<i>Parametaphoxus fultoni</i> (in Barnard, 1960 in part)	P (AL-CAL)
<i>Parametaphoxus quaylei</i> Jarrett & Bousfield, 1994b	P (BC-ORE)
<i>Phoxocephalus holbolli</i> (Kroyer, 1842)	A-At (AC-CHES)

Subfamily Harpiniinae Barnard & Drummond, 1978

<i>Coxophoxus hidalgo</i> J. L. Barnard, 1966	P (CAL)
<i>Harpinia antennaria</i> Meinert, 1893	AP, At (V, deep slope)
<i>H. clivicola</i> Watling, 1981	At (off DEL)
<i>H. cabotensis</i> Shoemaker, 1930	At (AC)
<i>H. pectinata</i> G.O. Sars, 1891	AP, At (S to Hatteras) (see Watling)
<i>H. plumosa</i> (Kroyer, 1842)	At (St.L)
<i>H. propinqua</i> Sars, 1891	At (AC) C Hat. Watling, 1981
<i>H. serrata</i> Sars, 1879	At, G deep?
<i>H. truncata</i> Sars, 1894	At (to Mid At) (see Watling)
<i>Harpiniopsis fulgens</i> J. L. Barnard, 1960	P (BC-CAL)
<i>H. emeryi</i> Barnard, 1960	P (CAL?)
<i>H. epistomata</i> Barnard, 1960	P (S CAL)
<i>H. fulgens</i> Barnard, 1960	P (CAL)
<i>H. galera</i> Barnard, 1960	P (CAL)
<i>H. gurjanovae</i> Bulycheva, 1936	P (BER)
<i>H. naiadis</i> Barnard, 1960	P (S CAL)
<i>H. percellaris</i> Barnard, 1971	P (ORE, deep)
<i>H. petulans</i> Barnard, 1966	P (CAL)
<i>H. profundis</i> Barnard 1960	P (CAL?)
<i>H. triplex</i> Barnard, 1971	P (ORE, deep)
<i>Heterophoxus affinis</i> (Holmes, 1908)	P (SE AL-CAL)
<i>H. oculatus</i> (Holmes, 1908)	P (S CAL)
<i>H. conlanae</i> Jarrett & Bousfield, 1994b	P (SE AL-ORE)
<i>H. ellisi</i> Jarrett & Bousfield, 1994b	P (BC-ORE)
<i>H. ellisi</i> variant Jarrett & Bousfield, 1994b	P (BC)
<i>H. nitellus</i> Barnard, 1990	P (S. CAL)
<i>Pseudharpinia excavata</i> Chevreux, 1887	P (CAL)
<i>P. inexpectata</i> Jarrett & Bousfield, 1994b	P (BC)
<i>P. sanpedroensis</i> (Barnard, 1960)	P (S CAL)

Superfamily Eusiroidea Bousfield, 1979**Family Amathillopsidae Pirlot, 1934 (transferred to Iphimedioidea by Lowry & Myers, 2000)**

<i>Amathillopsis spinigera</i> Heller, 1875	P -At (pelagic)
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Family Bateidae Stebbing, 1906

<i>Batea catharinensis</i> Müller, 1865	G (FL)
<i>B. bousfieldi</i> Ortiz, 1991	G (W FL)
<i>B. lobata</i> Shoemaker, 1926	P (S CAL)
<i>B. transversa</i> Shoemaker, 1926	P (S CAL)
<i>Carinobatea cuspidata</i> Shoemaker, 1926	G (W FL)
<i>C. carinata</i> Shoemaker, 1926	G (FL)

Family Eusiridae Stebbing, 1888

<i>Cleonardo moirae</i> Bousfield & Hendrycks, 1995a	P (BC, pelagic)
<i>Eusirella elegans</i> Chevreux, 1908	At (ST L)

<i>E. multicalceola</i> (Thorsteinson, 1941)	P (BC-WA, pelagic)
<i>Eusirogenes deflexifrons</i> Shoemaker, 1930	At (ST L)
<i>Eusiroides monoculoides</i> (Haswell, 1879)	P (CAL)
<i>Eusirus columbianus</i> Bousfield & Hendrycks, 1995a	P (BC)
<i>Eusirus cuspidatus</i> Kroyer, 1845	P, At (ST L)
<i>Eusirus longipes</i> Boeck, 1871	At (ST L, slope)
<i>Eusirus propinquus</i> G. O. Sars, 1893	At (ST L, slope)
<i>Rhachotropis aculeata</i> (Lepechin, 1780)	A-P
<i>R. americana</i> Bousfield & Hendrycks, 1995a	P (BC)
<i>R. barnardi</i> Bousfield & Hendrycks, 1995a	P (CAL)
<i>R. boreopacifica</i> Bousfield & Hendrycks, 1995a	P (SE AL-BC)
<i>R. cervus</i> Barnard, 1957	P (S CAL)
<i>R. clemens</i> Barnard, 1967	P (CAL)
<i>R. conlanae</i> Bousfield & Hendrycks, 1995a	P (BC)
<i>R. distincta</i> (Holmes, 1908)	P (pelagic), At (ST L)
<i>R. inflata</i> (Sars, 1883)	P (AL-CAL) At (ST L, slope)
<i>R. ludificor</i> Barnard, 1967	P (CAL)
<i>R. luculenta</i> Barnard, 1969	P (S CAL?)
<i>R. oculata</i> (Hansen, 1888)	At-A-P
<i>R. minuta</i> Bousfield & Hendrycks, 1995a	P (BC)
<i>R. natator</i> (Holmes, 1908)	P (pelagic)
<i>Rozinante fragilis</i> (Goes, 1866)	A-At (ST L)

Family Gammaracanthidae Bousfield, 1977

<i>Gammaracanthus loricatus</i> Sabine, 1824	A-At (AC)
<i>Pseudacanthus aestuariorum</i> (Lomakinia, 1952)	P (AL)-A-At (AC)(Dadswell, 1974)

Family Gammarellidae Bousfield, 1977

<i>Gammarellus homari</i> (L., 1768)	A-At (AC)
<i>G. angulosus</i> (Rathke, 1843)	At (AC)

Family Pontogeneiidae Stebbing, 1906

<i>Accedomoera vagor</i> J. L. Barnard, 1969	P (SE AL-CAL)
<i>A. melanophthalma</i> (Gurjanova, 1938)	P (SE AL-CAL)
<i>Nasageneia quinsana</i> (Barnard, 1964)	P (S CAL)
<i>N. yucatenensis</i> Ledoyer, 1986	G (FL)
<i>Paramoera (Paramoera) columbiana</i> Bousfield, 1958	P (SE AL-ORE)
<i>P. (Paramoera) mohri</i> Barnard, 1958	P (CAL-WA)
<i>P. (Paramoera) bousfieldi</i> Staude, 1995	P (SE AL-ORE)
<i>P. (Paramoera) serrata</i> Staude, 1995	P (WA-CAL)
<i>P. (Paramoera) suchaneki</i> Staude, 1995	P (SE AL-S CAL)
<i>P. (Rhithromoera) bucki</i> Staude, 1995	P (SE AL-WA)
<i>P. (Rhithromoera) carlottensis</i> Bousfield, 1958	P (SE AL-BC)
<i>P. (Humilomoera) leucophthalma</i> Staude, 1995	P (SE AL-WA)
<i>P. (Humilomoera) crassicauda</i> Staude, 1995	P (AL)
<i>Pontogeneia inermis</i> (Kroyer, 1838)	P (BER-CAL)-A-At
<i>P. ivanovi</i> Gurjanova 1951	P (BER-WA)-A
<i>P. rostrata</i> Gurjanova, 1938	P (BER-CAL)-A

P.	<i>intermedia</i> Gurjanova, 1938	P (BER-CAL)-
P.	(<i>Tethygeneia</i>) <i>opata</i> Barnard, 1979	P (CAL)
P.	(<i>T.</i>) <i>longleyi</i> Shoemaker, 1933	G (FI)
P.	(<i>T.</i>) <i>bartschi</i> Shoemaker, 1948	G (FL-CUBA)

Family Calliopiidae G. O. Sars, 1895

<i>Apherusa bispinosa</i> (Bate, 1857)	At (GST L)
A. <i>cirrhus</i> (Bate, 1862)	A
A. <i>fragilis</i> (Goes, 1966)	A-At (ST L)
A. <i>glacialis</i> Hansen, 1888	A-P
A. <i>megalops</i> (Buchholz, 1874)	A-P (BER)
A. <i>retovskii</i> Gurjanova, 1934	A
A. <i>sarsi</i> Shoemaker, 1930	A
A. <i>tridentata</i> (Bruzellius, 1859)	A
<i>Bouvierella carcinophila</i> Chevreux, 1889	P (BC), At (ST L)
<i>Calliopijs behringi</i> Gurjanova, 1951	P (BER)
C. <i>columbianus</i> Bousfield & Hendrycks, 1997	P (SE AL-ORE)
C. <i>carinatus</i> Bousfield & Hendrycks, 1997	P (BC-CAL)
C. <i>laeviusculus</i> (Kroyer, 1838)	A-At-AC
C. <i>pacificus</i> Bousfield & Hendrycks, 1997	P B(BC-CAL)
C. <i>sablensis</i> Bousfield & Hendrycks, 1997	At (AC)
<i>Cleippides bicuspis</i> Stephenson, 1931	A
C. <i>quadricuspidis</i> Heller, 1875	A
<i>Dolobrotus mardeni</i> Bowman 1974	At (AC, deep)
<i>Halirages bispinosus</i> Stephensen 1916	At (ST L, deep)
H. <i>fulvocincta</i> (M. Sars, 1858)	A (Barrow), At (ST L)
H. <i>elegans</i> Norman, 1882	A
H. <i>mixta</i> Stephenson, 1931	A
H. <i>nilssoni</i> Ohlin, 1895	At-A (G, N, deep)
H. <i>quadridentata</i> Sars, 1876	A
<i>Haliragoides inermis</i> (Sars, 1882)	At-A (ST L)
<i>Laothoes meinerti</i> Boeck, 1871	A
L. <i>pacificus</i> Gurjanova, 1938	PA (BER)
L. <i>polylovi</i> Gurjanova, 1946	At (ST L - LABR, deep)
<i>Leptamphopus paripes</i> Stephensen, 1931	P (BC, deep), At (ST L, slope)
<i>Oligochinus lighti</i> J. L. Barnard, 1969	P (AL-CAL)
<i>Oradarea longimana</i> (Boeck, 1871)	P (BC-CAL), At (ST L, deep)
<i>Paracalliopiella pratti</i> Barnard, 1954	P (BER-CAL)
P. <i>beringiensis</i> Bousfield & Hendrycks, 1997	P-A (BER)
P. <i>haliragoides</i> Bousfield & Hendrycks, 1997	P-A (BER)
P. <i>kudrjaschovi</i> Bousfield & Hendrycks, 1997	P-A (BER)
P. <i>slatteryi</i> Bousfield & Hendrycks, 1997	P (BER)
<i>Weyprechtia pinguis</i> (Kroyer, 1838)	A-P-At (ST L-LABR)
W. <i>heuglini</i> (Buchholz, 1874)	A-P-At (ST L)

Superfamily Oedicerotoidea Bousfield, 1979

Family Oedicerotidae Lilljeborg, 1865.

<i>Acanthostepheia behringiensis</i> (Lockington, 1877)	A (BER)
A. <i>malmgreni</i> (Goes, 1866)	P (BER), A-At (ST L, deep)

- Aceroides distinguendus* (Hansen, 1888)
A. *edax* J. L. Barnard, 1967
A. *goesi* Just, 1980
A. *latipes* (Sars, 1882)
A. *sedovi* Gurjanova, 1946
Americhelidium americanum (Bousfield, 1973)
A. *millsi* Bousfield & Chevrier 1996
A. *pectinatum* Bousfield & Chevrier, 1996
A. *micropleon* (Barnard, 1977)
A. *setosum* Bousfield & Chevrier, 1996
A. *variabilum* Bousfield & Chevrier, 1996
A. *shoemakeri* (Mills, 1962)
A. *rectipalmum* (Mills, 1962)
Ameroculodes edwardsi (Holmes, 1903)(Ledoyer, 1972)
A. *holmesi* Bousfield 1996
Arrhinopis longicornis Stappers, 1911
Arrhis lutkeni Gurjanova, 1936
A. *phyllonyx* (M. Sars, 1858)
Bathymedon antennarius Just, 1980
B. *covilhani* J. L. Barnard, 1961
B. *flebilis* Barnard, 1967
B. *kassites* Barnard, 1966
B. *longimanus* (Boeck, 1871)
B. *nanseni* Gurjanova, 1946
B. *pumilis* Barnard, 1962
B. *obtusifrons* (Hansen, 1887)
B. *roquedo* Barnard, 1962
B. *saussurei* (Boeck, 1871)
B. *vulpeculus* Barnard, 1971
Deflexilodes enigmaticus Bousfield & Chevrier, 1996.
D. *intermedius* Shoemaker 1930
D. *norvegicus* (Boeck 1871)
D. *similis* Bousfield & Chevrier, 1996
D. *simplex* Hansen, 1887
D. *tesselatus* Schneider, 1884
D. *tuberculatus* Boeck, 1871
Finoculodes omnifera Barnard, 1971
Hartmanodes hartmanae (Barnard, 1962)
H. *nyi* (Shoemaker, 1933)
Kroyera carinata Bate, 1857
Machaironyx muelleri Coyle, 1980
Monoculodes brevirostris Bousfield & Chevrier, 1996
M. *castalskii* Gurjanova, 1951
M. *diamesus* Gurjanova, 1936
M. *demissus* Stimpson, 1853
M. *emarginatus* J. L. Barnard, 1962
M. *glyconicus* Barnard, 1967
M. *latissimanus* (Stephensen, 1931)
M. *latimanus* (Goes, 1861)
M. *longirostris* (Goes, 1866)
M. *murrius* Barnard, 1962
A (BAR)
P (CAL, deep)
A
P (SE AL-BC), A-At (ST L deep)
A
G (FL))
P (WA)
P (BC-ORE)
P (S CAL)
P (SE AL-BC)
P (BC-WA)
P (BER-CAL)
P (BER-CAL)
At (AC) (not FL!)
At (V) G (FL?)
A-At (ST L)
P (AL?)
A-At (ST L, slope)
A
P (ORE, deep)
P (ORE-CAL, deep)
P (CAL-deep)
At (G, N, slope)
P (BER-BC)A-At (ST L)
P (ORE-S CAL)
A-At (ST L)
P (CAL)
At (ST L)
P (ORE-S CAL, deep)
P (SE AL-BC)
A-At (AC) (not FL!)
P (S CAL), At -(ST L)
P (AL-BC)
A-At (ST L, slope)
At (ST L)
A-At (ST L, slope)
P (ORE, deep)
P (S. CAL)
G (FL) (see Ortiz, 1979)
P (BC?)
P (BER)
P (BC)
P (BER)
P (BER?-BC)
AT (AC)
P (ORE-CAL)
P (CAL, deep)
P (ORE-BC?), At (ST L)
P (SE AL-WA)-A-At (ST L, slope)
A-At (N, slope)
P (CAL)

<i>M. necopinus</i> Barnard, 1967	P (CAL, deep)
<i>M. packardi</i> Boeck, 1871	A-At (AC)
<i>M. perditus</i> J. L. Barnard, 1966	P (BC-S CAL)
<i>M. recandesco</i> Barnard, 1967	P (ORE, deep)
<i>M. sudor</i> Barnard, 1967	P (Cal, deep)
<i>M. tenuirostratus</i> Boeck, 1871	At (N, slope)
<i>Monoculopsis longicornis</i> (Boeck, 1871)	P (BER)-A-At(AC)
<i>Oediceroides trepadora</i> (Barnard, 1961)	P (ORE-CAL, deep)
<i>Oedicerus borealis</i> Boeck, 1871	A-At (AC)
<i>O. saginatus</i> Kroyer, 1842	A-At (G)
<i>Pacifoculodes spinipes</i> (Mills, 1962)	P (BC-ORE)
<i>P. bruneli</i> Bousfield & Chevrier 1996	P (SE AL)
<i>P. barnardi</i> Bousfield & Chevrier, 1996	P (CAL)
<i>P. levingsi</i> Bousfield & Chevrier, 1996	P (BC)
<i>P. crassirostris</i> (Hansen, 1887)	P (AL)
<i>P. zernovi</i> (Gurjanova, 1936)	P (BER-BC)
<i>Paroedicerus behringiensis</i> Lockington, 1877	P (BER)-A
<i>P. lynceus</i> (M. Sars, 1858)	P (ALEUT), A-At (ST L, slope)
<i>P. propinquus</i> (Goes, 1866)	A-At ST L, slope)
<i>Perioculodes cerasinus</i> Thomas & Barnard, 1985	G (FL-BL)
<i>P. longimanus</i> (Bate & Westwood, 1868)	At (ST L)
<i>Rostroculodes borealis</i> (Boeck, 1871)	P-A (BAR), At-A (G, N)
<i>R. hanseni</i> Stebbing, 1894	A
<i>R. kroyeri</i> (Boeck, 1871)	A-At (ST L, slope)
<i>R. longirostris</i> (Goes, 1866)	P-A (BAR)
<i>R. schneideri</i> (Sars, 1895)	P-A (BAR), A-At (ST L)
<i>R. vibei</i> (Just, 1980)	A-At (LABR)
<i>Synchelidium tenuimanum</i> Norman 1895	At (ST L, shelf)
<i>Westwoodilla brevicar</i> (Goes, 1866)	P (BC-CAL), A-At (ST L)
<i>W. megalops</i> (Sars, 1882) (syn with <i>caecula</i> ?)	A

Superfamily Leucothoidea Bousfield, 1979

Family Leucothoidae Dana, 1852

<i>Anamixis cavitura</i> Thomas, 1997	G (NE)
<i>A. hanseni</i> Stebbing 1899	G (MI)
<i>A. linsleyi</i> Barnard, 1955	P (S CAL)
<i>Leucothoe alata</i> J. L. Barnard, 1959	P (S CAL)
<i>L. spinicarpa</i> (Abildgaard, 1789)	A-At (ST L)
<i>Leucothoides pacifica</i> Barnard, 1955	P (S CAL)
<i>L. pottsi</i> Shoemaker, 1933	G (FL)
(= <i>Anamixis linsleyi</i> J. L. Barnard, 1955)	

Family Pleustidae Buchholz, 1874

Subfamily Pleustinae Bousfield & Hendrycks, 1994a

<i>Pleustes (Pleustes) panoplus</i> (Kroyer, 1838)	At (A-AC)
<i>Pleustes (Pleustes) panoplus</i> var 4 Bousfield & Hendrycks, 1994b	P (BER)-A
<i>Pleustes (P.) panoplus</i> var. 5 Bousf. & Hendrycks, 1994b	P (BER)

<i>Pleustes</i> (<i>P.</i>) <i>tuberculatus</i> (Bate, 1858)	P (BER)
<i>Pleustes</i> (<i>Catapleustes</i>) <i>victoriae</i> Bousfield & Hendrycks, 1994b	P (BC)
<i>P.</i> (<i>C.</i>) <i>constantinus</i> Bousfield & Hendrycks, 1994b	P (BER)
<i>P.</i> (<i>C.</i>) <i>constantinus</i> var., Bousf. & Hendrycks, 1994b	P (BC)
<i>Thorlaksonius amchitkanus</i> Bousfield & Hendrycks, 1994b	P (BER)
<i>T.</i> <i>borealis</i> Bousfield & Hendrycks, 1994b	P (SE AL-ORE)
<i>T.</i> <i>depressus</i> (Alderman, 1936)	P (ORE-CAL)
<i>T.</i> <i>platypus</i> (Barnard & Given, 1960)	P (CAL)
<i>T.</i> <i>brevirostris</i> Bousfield & Hendrycks, 1994b	P (SE AL-CAL)
<i>T.</i> <i>subcarinatus</i> Bousfield & Hendrycks, 1994b	P (SE AL-ORE)
<i>T.</i> <i>grandirostris</i> Bousfield & Hendrycks, 1994b	P (BC-CAL)
<i>Thorlaksonius carinatus</i> Bousfield & Hendrycks, 1994b	P (SE AL-BC)
<i>T.</i> <i>truncatus</i> Bousfield & Hendrycks, 1994b	P (BC)

Subfamily Mesopleustinae Bousfield & Hendrycks, 1994a

<i>Mesopleustes abyssorum</i> (Stebbing, 1888)	P (ORE deep)
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Subfamily Pleustoidinae Bousfield & Hendrycks, 1994a

<i>Pleustoides carinatus</i> (Gurjanova, 1972)	P (BER?)
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Subfamily Atylopsinae Bousfield & Hendrycks, 1994a, emend Cadien & Martin, 1999

<i>Myzotarsa anixiphilius</i> Cadien & Martin, 1999	P (S CAL)
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Subfamily Eosymtinae Bousfield & Hendrycks, 1994a

<i>Eosymtes minutus</i> Bousfield & Hendrycks, 1994a	P (BC)
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Subfamily Stenopleustinae Bousfield & Hendrycks, 1994a

<i>Arctopleustes glabricauda</i> (Dunbar, 1954)	A-At (UNG)
<i>Stenopleustes gracilis</i> (Holmes, 1905)	At (AC-DEL) G (FL?)
<i>S.</i> <i>inermis</i> Shoemaker, 1949	At (AC-DEL)
<i>S.</i> <i>latipes</i> M. Sars, 1858)	At (ST L, slope)
<i>Sympleustes olricki</i> Hansen, 1887	A

Subfamily Pleusymtinae Bousfield & Hendrycks, 1994a

<i>Pleusymtes coquillus</i> Barnard, 1971	P (ORE-CAL)
<i>P.</i> <i>glaber</i> (Boeck, 1861)?	P (CAL), A-At (AC)
<i>P.</i> <i>glabroides</i> (Dunbar, 1954)	A-At (LABR)
<i>P.</i> <i>pulchella</i> (G. O. Sars, 1876)	A-At (AC?)
<i>P.</i> <i>subglaber</i> (Boeck, 1871)	P (CAL)
<i>Pleustomesus medius</i> (Goes, 1866)	P?, A-At (ST L, slope)

Subfamily Pleusirinae Bousfield & Hendrycks, 1994a

<i>Pleusirus secorrus</i> Barnard, 1969	P (AL-CAL)
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Subfamily Dactylopleustinae Bousfield & Hendrycks, 1994a

Dactylopleustes echinoides Bousf. & Hendrycks, 1995b P (BC-CAL)

Subfamily Neopleustinae Bousfield & Hendrycks, 1994a

Neopleustes pulchellus (Kroyer, 1846) At-A (ST L, slope)
 "Parapleustes" *bicuspid* (Kroyer, 1838) A-At
 "P. " *assimilis* (Sars, 1895) A-At
 "P." *gracilis* Buchholz, 1874 At (G)
Pleustostenus displosus Gurjanova, 1972 P (BER?)
 "Sympleustes" *cornigerus* Shoemaker, 1964 P-A (BAR)

Subfamily Parapleustinae Bousfield & Hendrycks, 1994a

Chromopleustes johanseni Bousfield & Hendrycks, 1995ab P (BER)
C. oculatus (Holmes, 1908) . P (AL-CAL)
C. lineatus Bousfield & Hendrycks, 1995ab P (SE AL- N CAL)
Incisocalliope aestuarius (Watling & Maurer, 1973) At (V); G (FL?)
I. karstensi J. L. Barnard, 1959 . A
Micropleustes nautilus (Barnard, 1969) P (AL-CAL)
M. nautiloides Bousfield & Hendrycks, 1995b P (BC-CAL)
Parapleustes americanus Bousfield & Hendrycks, 1995b P (AL-BC)
Gnathopleustes pugettensis (Dana, 1853) P (SE AL-CAL)
G. serratus Bousfield & Hendrycks, 1995b P (SE AL-CAL)
G. pachychaetus Bousfield & Hendrycks, 1995b P (SE AL-ORE)
G. trichodus Bousfield & Hendrycks, 1995b P (BC)
G. simplex Bousfield & Hendrycks, 1995b P (BC)
G. den (Barnard, 1969) P (CAL)
Trachypleustes trevori Bousfield & Hendrycks, 1995b . P (AL-BC)
T. vancouverensis Bousfield & Hendrycks, 1995b P (BC)
Commensipleustes commensalis (Shoemaker, 1952) P (CAL)
Incisocalliope aestuarius (Watling & Maurer, 1973) G (FL?)
I. newportensis Barnard, 1959 P (S CAL)
I. bairdi (Boeck, 1871) P (S CAL)
I. makiki (Barnard, 1970) P (HAW)

Superfamily Stenothoidea Bousfield (2001)**Family Amphilochidae Boeck, 1871****Subfamily Amphilochinae Barnard & Karaman, 1991**

Amphilochoides odontonyx (Boeck, 1871) A-At (shelf)
Apolochus barnardi Hoover & Bousfield, 2001 P (CAL)
A. casahoya (McKinney, 1978) G (FL-TEX)
A. delacaya (McKinney, 1978) G.
A. litoralis (Stout, 1912) P (SE AL-CAL)
A. manudens (Bate, 1862) At (ST L)
A. picadurus (Barnard, 1962) P (CAL)
A. staudei (Hoover & Bousfield, 2001) P (BC-WA)

A. <i>pillai</i> Barnard & Thomas, 1983	G (FL)
A. <i>tenuimanus</i> Boeck, 1871	A-At (ST L, slope)
<i>Gitana abyssicola</i> Sars, 1892	A-At (ST L, deep)
G. <i>calitemplado</i> Barnard, 1962	P (CAL)
G. <i>ellisi</i> Hoover & Bousfield, 2001	P (BC)
<i>Gitanopsis arctica</i> Sars, 1892	A-At ST L)
G. <i>bispinosa</i> (Boeck, 1871)	A-At (ST L)
G. <i>inermis</i> (Sars, 1882)	A-At (ST L, slope)
<i>Hourstonius vilordes</i> (Barnard, 1962)	P (SE AL-CAL)
H. <i>laguna</i> (McKinney, 1978)	G (FL-TEX)
H. <i>tortugae</i> (Shoemaker, 1933)	G (FL)

Subfamily Cyproideiinae Barnard & Karman, 1991

<i>Haplopheonoides obesa</i> Shoemaker, 1956	G (FL)
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Family Stenothoidae Boeck, 1871

<i>Mesometopa esmarki</i> (Boeck, 1871)	P (CAL)
M. <i>neglecta</i> Barnard, 1966	P (CAL)
M. <i>sinuata</i> Shoemaker, 1964	P (ORE-CAL)
<i>Metopa alderi</i> (Bate, 1857)	A-At
M. <i>abyssalis</i> Stephensen, 1931.	A (G-EM)
M. <i>boeckii</i> Sars, 1892	A-At
M. <i>borealis</i> Sars, 1882	A-At
M. <i>bruzelii</i> (Goes, 1866)	A-At (ST L)
M. <i>cistella</i> Barnard, 1969	P (CAL)
M. <i>clypeata</i> (Kroyer, 1842)	A-At
M. <i>dawsoni</i> Barnard, 1962	P (CAL)
M. <i>glacialis</i> (Kroyer, 1842)	P (BER), A-At (ST L)
M. <i>groenlandica</i> (Hansen, 1887)	A-At (ST L)
M. <i>invalida</i> G. O. Sars, 1892	At (ST L)
M. <i>leptocarpa</i> G. O. Sars, 1882	A-At (ST L)
M. <i>longicornis</i> Boeck, 1870	A-At (ST L)
M. <i>norvegica</i> (Lilj, 1950?)	At ST L)
M. <i>propinqua</i> G. O. Sars, 1892	A-At (ST L)
M. <i>pusilla</i> G. O. Sars 1892	At (ST L)
M. <i>robusta</i> Sars, 1892	A-At (ST L)
M. <i>samsiluna</i> Barnard, 1962	P (CAL)
M. <i>sinuata</i> Sars, 1892	A-At-(ST L)
M. <i>solsbergi</i> Schneider, 1884	At (ST L)
M. <i>spinicoxa</i> Shoemaker, 1955	A (AC)
M. <i>spitzbergensis</i> Brüggén, 1909	A-At (St L)
M. <i>sporpi</i> Barnard, 1969	P (CAL, deep)
M. <i>tenuimana</i> Sars, 1892	A-At (ST L)
<i>Metopella aporpi</i> Barnard, 1962	P (CAL)
M. <i>carinata</i> (Hansen, 1887)	A-At
M. <i>longimana</i> (Boeck 1871)	A-At
M. <i>nasuta</i> (Boeck, 1871)	A-At
<i>Metopelloides micropalpa</i> (Shoemaker, 1930)	At (AC)

<i>M. tattersalli</i> Gurjanova, 1938	A (BAR)
<i>Parametopa alaskensis</i> Holmes, 1904	P (AL)
<i>P. crassicornis</i> Just, 1980	A-At (ST L)
<i>Parametopella cypris</i> (Holmes 1905)	At (V-C) G (W FL)
<i>P. inquilina</i> Watling, 1976	At (C-V) G (FL)
<i>P. ninis</i> Barnard, 1962	P (CAL)
<i>P. texensis</i> McKinney et al, 1978	G (W FL)
<i>P. cf. texensis</i> McKinney, Kalke & Holland, 1978	G (FL)
<i>Proboloides holmesi</i> Bousfield, 1973	At (V)
<i>P. nordmanni</i> (Stephensen, 1931)	A-At
<i>P. pacifica</i> (Holmes, 1908)	P (CAL, deep)
<i>P. tunda</i> Barnard, 1962	P (CAL)
<i>Raumajara carinata</i> (Shoemaker, 1955)	P, A (BAR)
<i>Stenothoe alaskensis</i> Holmes, 1904	P (BER)
<i>S. brevicornis</i> Sars, 1882	A-G?
<i>S. estacola</i> Barnard, 1962	P (CAL)
<i>S. frecanda</i> Barnard, 1962	P (CAL)
<i>S. georgiana</i> Bynum & Fox, 1977	At (C); G (FL)
<i>S. gallensis</i> Walker, 1904	G (FL)
<i>S. marina</i> Bate, 1857	P (CAL?) - At?
<i>S. minuta</i> Holmes, 1905	G (FL)
<i>S. monoculoides</i> Montagu, 1815	At (ST L)
<i>S. symbiotica</i> Shoemaker, 1956	G (FL)
<i>S. valida</i> Dana, 1852	P (CAL)
<i>Stenothoides bicoma</i> Barnard, 1962	P (CAL)
<i>S. burbancki</i> Barnard, 1969	P (CAL)
<i>Stenula incola</i> Barnard, 1969	P (CAL)
<i>S. modosa</i> Barnard, 1962	P (CAL)
<i>S. nordmanni</i> (Stephensen, 1931)	P (BAR), A-At (ST L)
<i>S. peltata</i> (S. I. Smith, 1874)	A-At (ST L, slope)
<i>Zaikometopa erythrophthalmus</i> (Coyle & Mueller, 1981)	P (AL)

Superfamily Iphimedioidea Lowry & Myers, 2000

Family Epimeriidae Boeck, 1871 (=Paramphithoidae Sars, 1895)

<i>Epimeria cora</i> Barnard, 1971	P (deep)
<i>E. longispinosa</i> K.H. Barnard, 1916	At (E FL deep)
<i>E. loricata</i> G.O Sars, 1879	A-At (G-BF)
<i>E. obtusa</i> Watling, 1981	At (C -E FL)
<i>E. yaquinae</i> McCain, 1971	P (ORE, deep)
<i>Paramphithoe hystrix</i> Ross, 1835	P-A-At (G, N, slope)
<i>P. polyacantha</i> (Murdoch, 1885)	A
<i>Ushakoviella echinophora</i> Gurjanova, 1955	P (BER-SE AL)

Family Iphimediidae Boeck, 1871

<i>Acanthonotozoma inflatum</i> (Kroyer, 1842)	A-At
<i>A. monodentatus</i> Kudrjaschov, 1965	P (BER?)
<i>A. rusanovae</i> Bryazhgin, 1974	P (BC-AL), At (ST L)

<i>Acanthonotozoma serratum</i> (Fabricius, 1780)	A-At (ST L)
<i>A. sinuatum</i> Just, 1978	A-At (ST L)
<i>Coboldus hedgpethi</i> (Barnard, 1969)	P (CAL)
<i>Curidia debrogania</i> Thomas, 1983	G (FL)
<i>Iphimedia rickettsi</i> Shoemaker, 1931	P (AL)
<i>I. zora</i> Thomas & Barnard, 1991	G (FL)

Family Odiidae Coleman & Barnard, 1991

<i>Cryptodius kelleri</i> (Bruggen, 1907)	P (BC-CAL)
<i>C. unguidactylus</i> Moore, 1992	P (BC)
<i>Imbrexodius oclairi</i> Moore, 1992	P (BC)

Incerta sedis

Family Lafystiidae Sars, 1895

<i>Lafystius acuminatus</i> Bousfield, 1987	AT (V), G (FL?)
<i>L. frameae</i> Bousfield, 1987	AT (V), G (FL?)
<i>L. morrhua</i> Bousfield, 1987	A-At (AC)
<i>L. sturionis</i> Kroyer, 1842	A-At (AC)
<i>Paralafystius mcallisteri</i> Bousfield, 1987	P (SE AL-BC)
<i>Protolafystius madillae</i> Bousfield, 1987	P (BC)

Superfamily Dexaminoidea Bousfield, 1979

Family Atylidae G. O. Sars, 1882

Subfamily Atylinae Boeck, 1871; revised Bousfield & Kendall 1994

<i>Atylus carinatus</i> (Fabricius, 1793)	P (BER)-A-At (ST L)
<i>A. atlassovi</i> (Gurjanova, 1951)	P (BER)-A
<i>A. borealis</i> Bousfield & Kendall, 1994	P (SE AL-WA)
<i>A. bruggeni</i> (Gurjanova, 1938)	P (BER)-A
<i>A. collingi</i> (Gurjanova, 1938)	P (BER)-A
<i>A. georgianus</i> Bousfield & Kendall, 1994	P (BC-ORE)
<i>A. melanops</i> (Oldevig, 1959)	A
<i>A. nordlandicus</i> Boeck, 1871	A
<i>A. rylovi</i> (Bulycheva, 1952)	P (W PAC)
<i>A. tridens</i> (Alderman, 1936)	P (BC-CAL)

Subfamily Nototropinae Bousfield & Kendall, 1994

<i>Aberratylus aberrantis</i> (J. L. Barnard, 1962)	P (CAL?, deep)
<i>Nototropis minikoi</i> (Walker, 1905)	At (V-C), G (E FI?)
<i>N. smithi</i> Goes, 1866	A, At ?
<i>N. swammerdamii</i> (Milne-Edwards, 1830)	AT (AC-V), G?
<i>N. urocarinatus</i> McKinney, 1980	G (FL-TEX)

Subfamily Lepechinellinae Schellenberg, revised Barnard & Karaman 1991

<i>Lepechinella bieri</i> Barnard, 1957	P (CAL, deep)
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Subfamily Anatylinae Bulycheva, 1955; revised Bousfield & Kendall, 1994

Kamehatylus nani Barnard, 1970

P (HAW)

Family Dexaminidae Leach, 1813/14

Subfamily Polycheriinae Bousfield & Kendall, 1994

Polycheria osborni Calman, 1898

P (SE AL-CAL)

P. carinata Bousfield & Kendall, 1994

P (BC)

P. mixillae Bousfield & Kendall, 1994

P (BC)

Subfamily Prophliantinae Nicholls, 1939

Guernea nordenskioldii (Hansen, 1887)

A-At (AC)

G. reduncans (Barnard, 1958)

P (BC-CAL)

Subfamily Dexamininae Leach, 1813/14; revised Bousfield & Kendall, 1994

Dexamine thea Boeck, 1861

At (AC)

Superfamily Ampeliscoidea Bousfield, 1979

Family Ampeliscidae Costa, 1857

Ampelisca abdita Mills, 1964

At (ST L, V-C), G (?)

A. aequicornis Bruzelius, 1859

At-A (AC)

A. agassizi (Judd, 1896A)

P (CAL)-At (V), G (E-FL)

(= *A. vera* Barnard, 1954)

A. amblyops Sars, 1891

At (FL, deep)

A. amblyopsoides J. L. Barnard, 1960

P (CAL)

A. bicarinata Goeke & Heard, 1983

G (FL-MI)

A. birulai Brüggén, 1909

P (BER), A

A. brachycladus Roney, 1990

P (CAL?)

A. brevisimulata Barnard, 1954

P (ORE-BC)

A. burkei Barnard & Thomas, 1989

G (FL)

A. careyi Dickinson, 1982

P (BC-ORE)

A. ciego Barnard, 1966

P (CAL)

A. coeca Holmes, 1908

P (S CAL)

A. cristata Holmes, 1908

P (BC-ORE)

A. cristoides Barnard, 1954

P (S CAL)

A. declivitatus Mills, 1967

At (deep) (ST L)

A. eoa Gurjanova, 1951

P (BER)

A. erythrorhabdota Coyle & Highsmith, 1989

P (BER)

A. eschrichti Kroyer, 1842

P (BER?)-A-At (ST L)

A. fageri Dickinson, 1982

P (ORE)

(= *A. schellenbergi* Shoemaker, 1933)

A. furcigera Gurjanova, 1936

P (BER)

A. gibba Sars, 1882

At (ACdeep)

A. hancocki Barnard, 1954

P (BC-ORE)

A. hessleri Dickinson, 1982

P (ORE)

A. holmesi Pearse, 1908

G (FL-MI)

A.	<i>indentata</i> Barnard, 1954	P (CAL)
A.	<i>latipes</i> Stephensen, 1925	At (ST L-AC)
A.	<i>lobata</i> Holmes, 1908	P (AL)
	(= <i>A. articulata</i> Stout, 1913)	
A.	<i>macrocephala</i> Liljeborg, 1852	P (BER)-A-At (AC)
A.	<i>mexicana</i> Barnard, 1954	P (S CAL)
A.	<i>milleri</i> Barnard, 1954	P (CAL)
A.	<i>pacifica</i> Holmes, 1908	P (CAL)
A.	<i>plumosa</i> Holmes, 1908	P (AL)
A.	<i>pugetica</i> Stimpson, 1864	P (BC-WA)
A.	<i>romigi</i> Barnard, 1954	P (CAL)
A	<i>schellenbergi</i> (see Coyle & Highsmith, 1989)	P (BER)
A.	<i>shoemakeri</i> Barnard, 1954	P (CAL)
A.	<i>typica</i> (Bate, 1856)	AT (AC)
A.	<i>uncinata</i> Chevreux, 1887	At (AC, deep)
A.	<i>unsocolae</i> Barnard, 1960	P (ORE)
A.	<i>vadorum</i> Mills, 1963	At (G, V)(E FL?)
A.	<i>venetiensis</i> Shoemaker, 1916	P (CAL)
A.	<i>verrilli</i> Mills, 1967	At (V-C?)(E FL?)
<i>Byblis</i>	<i>barbarensis</i> Barnard, 1960	P (CAL)
B.	<i>bathyalis</i> Barnard, 1966	P (CAL)
B.	<i>brevirama</i> Dickinson, 1983	P (ORE),- A
B.	<i>crassicornis</i> Metzger, 1875	P (BER?)
B.	<i>frigidis</i> Coyle & Highsmith, 1989	P (BER)
B.	<i>gaimardii</i> (Kroyer, 1846)?	P (BER?)-A-At (AC)
B.	<i>longispina</i> Dickinson, 1983	P (BC)
B.	<i>medialis</i> Mills, 1971	At (AC, deep)
B.	<i>millsi</i> Dickinson, 1983	P (BC)
B.	<i>mulleni</i> Dickinson, 1983	P (ORE)
B.	<i>pearcyi</i> Dickinson, 1983	P (BER),- A
B.	<i>robustus</i> Coyle & Highsmith, 1989	P (BER)
B.	<i>serrata</i> S. I. Smith, 1873	At (V), G (E FL?)
B.	<i>tannerensis</i> Barnard, 1966	P (CAL)
B.	<i>teres</i> (see C. & H., 1989)	P (BER)
B.	<i>thyabilis</i> Barnard, 1971	P (ORE)
B.	<i>veleronis</i> Barnard, 1954	P (BC-CAL)
<i>Haploops</i>	<i>fundiensis</i> Wildish & Dickinson, 1982	At (AC)
H.	<i>laevis</i> Hoek, 1882	P (CAL)-A-At (ST L)
H.	<i>sibirica</i> Gurjanova, 1929	A
H.	<i>lodo</i> Barnard, 1961	P (CAL?)
H.	<i>setosa</i> Boeck, 1871	P (ER), At (AC)
H.	<i>similis</i> Stephensen, 1925	At (AC, shelf to deep)
H.	<i>spinosa</i> Shoemaker, 1931	At (AC)
H.	<i>tubicola</i> Liljeborg, 1856	P (BER)-A-At (ST L)

Superfamily Melphidippoidea Bousfield, 1979 [= cheirocratids Barnard & Barnard, 1983 (part)]

Family Melphidippidae Stebbing, 1899

<i>Casco bigelowi</i> (Blake, 1929)	At (ST L-AC-DEL)
<i>Melphisana bola</i> Barnard, 1962	P (AL-CAL)
<i>Melphidipella macer</i> (Norman, 1869)	P (BC)
<i>Melphidippa amorita</i> Barnard, 1966	P (CAL)?
<i>M. borealis</i> Boeck, 1971	P -A?-At (ST L)
<i>M. goesi</i> Stebbing, 1899	A-At (AC)
<i>M. macrura</i> G. O. Sars, 1894	At (ST L)

Family Hornelliidae Bousfield, 1982

<i>Hornellia (Metaceradocus) tequestae</i> Thomas & Barnard, 1986	G (FL)
<i>H. occidentalis</i> (Barnard, 1959)	P (S CAL)

Family Megaluropidae Thomas & Barnard, 1986

<i>Megaluropus longimerus</i> Schellenberg, 1925?	P (BC-CAL)
<i>Gibberosus devaneyi</i> Thomas & Barnard, 1986	P (S CAL?)
<i>G. myersi</i> (McKinney, 1980)	P (CAL?); G (FL-TEX)
<i>G. visendus</i> (Barnard, 1969)	P (B CAL)
<i>Resupinus coloni</i> Thomas & Barnard, 1986	P (CAL)

Superfamily Liljeborgioidea, Bousfield, 1979

Family Liljeborgiidae Stebbing, 1899

<i>Idunella aequicornis</i> (Sars, 1876)	A-At (ST L)
<i>I. bowenae</i> Karaman, 1979	At (V, shelf)
<i>I. smithi</i> Lazo-Wasem, 1985	At (V), G (E FL?)
<i>Liljeborgia bousfieldi</i> McKinney, 1979	G (FL-TEX)
<i>L. cota</i> Barnard, 1962	P (ORE-CAL, deep)
<i>L. fissicornis</i> M. Sars, 1858?)	A-At (N, slope)
<i>L. geminata</i> Barnard, 1969	P (CAL?)
<i>L. pallida</i> (Bate, 1857)	P (CAL)? G (FL)
<i>Listriella albina</i> Barnard, 1959	P (ORE-CAL, deep)
<i>L. barnardi</i> Wigley, 1966	At (V-C), G (W FL)
<i>L. carinata</i> McKinney, 1979	G (FL-TEX)
<i>L. clymenellae</i> Mills, 1962	At (V-C), G (FL?)
<i>L. diffusa</i> Barnard, 1959	P (CAL)
<i>L. eriopisa</i> Barnard, 1959	P (S CAL)
<i>L. goleta</i> Barnard, 1959	P (ORE-CAL)
<i>L. melanica</i> Barnard, 1959	P (CAL)
<i>L. quintana</i> McKinney, 1979	G (TEX)

Family Sebidae Walker, 1908

Subfamily Sebiniae Holsinger 1980

<i>Seba aloe</i> Karaman, 1971	G (W FL)
<i>S. profunda</i> Shaw, 1989	P (BC, deep)

Subfamily Seborgiinae Karaman, 1992

<i>Relictoseborgia hershleri</i> (Holsinger, 1992b)	FW (TEX)
? <i>R. relict</i> a (Holsinger, 1980)	FW (TEX)

Family Colomastigidae Stebbing, 1899

<i>Colomastix bousfieldi</i> LeCroy 1995	G (FL-TEX)
<i>C. camura</i> LeCroy, 1995	At (C), G (FL-TEX)
<i>C. cornuticauda</i> LeCroy, 1995	G (W FLA)
<i>C. denticornis</i> LeCroy, 1995	G (W FL)
<i>C. falcirama</i> LeCroy, 1995	G (FL)
<i>C. gibbosa</i> LeCroy, 1995	G (FL)
<i>C. halichondriae</i> Bousfield, 1973	At, G (FL-TEX)
<i>C. heardi</i> LeCroy, 1995	AT (C), G (FL-YUC)
<i>C. ircinia</i> e LeCroy, 1995	G (FL)
<i>C. janiceae</i> Heard & Perlmutter, 1977	G (FL-YUC), At (C)
<i>C. tridentata</i> LeCroy, 1995	At (C), G (FL-YUC)

Superfamily Crangonyctoidea Bousfield 1973 [= crangonyctoids Barnard & Barnard, 1983 (part)]

Family Crangonyctidae Bousfield 1973 (revised Holsinger 1977)

<i>Batrurus brachycaudus</i> Hubricht & Mackin, 1940	FW
<i>B. hubrichti</i> Shoemaker, 1945	FW
<i>B. mucronatus</i> (Forbes, 1876)	FW
<i>Crangonyx aberrans</i> D. Smith, 1983	FW
<i>C. alpinus</i> Bousfield, 1963	FW (P)
<i>C. anomalus</i> Hubricht, 1943	FW
<i>C. antennatus</i> Packard, 1881	FW
<i>C. dearolfi</i> Shoemaker, 1942	FW
<i>C. floridanus</i> Bousfield, 1963	FW
<i>C. forbesi</i> (Hubricht & Mackin, 1940)	FW
<i>C. gracilis</i> Smith, 1871	FW
<i>C. grandimanus</i> Bousfield, 1963	FW
<i>C. hobbsi</i> Shoemaker, 1941	FW
<i>C. minor</i> Bousfield, 1958	FW
<i>C. obliquus</i> (Hubricht & Mackin, 1940)	FW
<i>C. packardi</i> S. I. Smith, 1888	FW
<i>C. pseudogracilis</i> Bousfield, 1958	FW
<i>C. richmondensis richmondensis</i> Ellis, 1940	FW
<i>C. r. occidentalis</i> Hubricht & Harrison, 1941	FW (P)
<i>C. r. laurentianus</i> Bousfield, 1958	FW
<i>C. rivularis</i> Bousfield, 1958	FW
<i>C. serratus</i> (Embry, 1911)	FW
<i>C. setodactylus</i> Bousfield, 1958	FW
<i>C. shoemakeri</i> (Hubricht & Mackin, 1940)	FW
<i>Stygonyx courtneyi</i> Bousfield & Holsinger, 1989	FW (P)
<i>Stygobromus abditus</i> Holsinger, 1978	FW
<i>S. ackerlyi</i> Holsinger, 1978	FW
<i>S. alabamensis alabamensis</i> (Stout, 1911)	FW

S.	<i>a. occidentalis</i> (Holsinger, 1967)	FW
S.	<i>allegheniensis</i> (Holsinger, 1967)	FW
S.	<i>araeus</i> (Holsinger, 1969)	FW
S.	<i>arizonensis</i> Holsinger, 1974	FW
S.	<i>balconis</i> (Hubricht, 1943)	FW
S.	<i>baroodyi</i> Holsinger, 1978	FW
S.	<i>barri</i> (Holsinger, 1967)	FW
S.	<i>barryi</i> Holsinger, 1978	FW
S.	<i>bifurcatus</i> (Holsinger, 1967)	FW
S.	<i>biggersi</i> Holsinger, 1978	FW
S.	<i>borealis</i> Holsinger, 1978	FW
S.	<i>bowmani</i> (Holsinger, 1967)	FW
S.	<i>canadensis</i> Holsinger, 1980	FW
S.	<i>carolinensis</i> Holsinger, 1978	FW
S.	<i>clantoni</i> (Creaser, 1934)	FW
S.	<i>coloradensis</i> Ward, 1977	FW
S.	<i>conradi</i> (Holsinger, 1967)	FW
S.	<i>cooperi</i> (Holsinger, 1967)	FW
S.	<i>cumberlandus</i> Holsinger, 1978	FW
S.	<i>dejectus</i> (Holsinger, 1967)	FW
S.	<i>dicksoni</i> Holsinger, 1978	FW
S.	<i>elatus</i> (Holsinger, 1967)	FW
S.	<i>elliotti</i> Holsinger, 1974	FW
S.	<i>emarginatus</i> (Hubricht, 1943)	FW
S.	<i>ephemerus</i> (Holsinger, 1969)	FW
S.	<i>estesi</i> Holsinger, 1978	FW
S.	<i>exilis</i> Hubricht, 1943	FW
S.	<i>fecundus</i> Holsinger, 1978	FW
S.	<i>ferausoni</i> Holsinger, 1978	FW
S.	<i>finleyi</i> Holsinger, 1978	FW
S.	<i>flagellatus</i> (Benedict, 1896)	FW
S.	<i>franzi</i> Holsinger, 1978	FW
S.	<i>gracilipes</i> (Holsinger, 1967)	FW
S.	<i>gradyi</i> Holsinger, 1974	FW
S.	<i>grahami</i> Holsinger, 1974	FW
S.	<i>grandis</i> Holsinger, 1978	FW
S.	<i>hadenoeus</i> (Holsinger, 1966)	FW
S.	<i>harai</i> Holsinger, 1974	FW
S.	<i>hayi</i> (Hubricht & Mackin, 1940)	FW
S.	<i>heteropodus</i> Hubricht, 1943	FW
S.	<i>hoffmani</i> Holsinger, 1978	FW
S.	<i>holsingeri</i> Ward, 1977	FW
S.	<i>hubbsi</i> Shoemaker, 1942	FW
S.	<i>indentatus</i> (Holsinger, 1967)	FW
S.	<i>inexpectatus</i> Holsinger, 1978	FW
S.	<i>interitus</i> Holsinger, 1978	FW
S.	<i>iowae</i> Hubricht, 1943	FW
S.	<i>kenki</i> Holsinger, 1978	FW
S.	<i>laticolus</i> Holsinger, 1974	FW
S.	<i>leensis</i> Holsinger, 1978	FW
S.	<i>longipes</i> (Holsinger, 1966)	FW

S.	<i>lucifugus</i> (Hay, 1882)	FW
S.	<i>mackenziei</i> Holsinger, 1974	FW
S.	<i>mackini</i> Hubricht, 1943	FW
S.	<i>minutus</i> Holsinger, 1978	FW
S.	<i>montanensis</i> Holsinger, 1974	FW
S.	<i>montanus</i> (Holsinger, 1967)	FW
S.	<i>morrisoni</i> (Holsinger, 1967)	FW
S.	<i>mundus</i> (Holsinger, 1967)	FW
S.	<i>mysticus</i> Holsinger, 1974	FW
S.	<i>nanus</i> Holsinger, 1978	FW
S.	<i>nortoni</i> (Holsinger, 1969)	FW
S.	<i>obrutus</i> Holsinger, 1978	FW
S.	<i>obscurus</i> Holsinger, 1974	FW
S.	<i>onondagaensis</i> (Hubricht & Mackin, 1940)	FW
S.	<i>oregonensis</i> Holsinger, 1974	FW
S.	<i>ozarkensis</i> (Holsinger, 1967)	FW
S.	<i>parvus</i> (Holsinger, 1969)	FW
S.	<i>pecki</i> (Holsinger, 1967)	FW
S.	<i>pennaki</i> Ward, 1977	FW
S.	<i>phreaticus</i> Holsinger, 1978	FW
S.	<i>pizzinii</i> (Shoemaker, 1938)	FW
S.	<i>pollostus</i> Holsinger, 1978	FW
S.	<i>pseudospinosus</i> Holsinger, 1978	FW
S.	<i>putealis</i> (Holmes, 1909)	FW
S.	<i>puteanus</i> Holsinger, 1974	FW
S.	<i>quatsinensis</i> Holsinger & Shaw, 1987	FW
S.	<i>redactus</i> Holsinger, 1978	FW
S.	<i>reddelli</i> (Holsinger, 1966)	FW
S.	<i>russelli</i> (Holsinger, 1967)	FW
S.	<i>secundus</i> Bousfield & Holsinger, 1981	FW
S.	<i>sheldoni</i> Holsinger, 1974	FW
S.	<i>sierrensis</i> Holsinger, 1974	FW
S.	<i>mithi</i> Hubricht, 1943	FW
S.	<i>sparsus</i> Holsinger, 1978 (1969?)	FW
S.	<i>spinatus</i> (Holsinger, 1967)	FW
S.	<i>spinosus</i> (Hubricht & Mackin, 1940)	FW
S.	<i>stegerorum</i> Holsinger, 1978	FW
S.	<i>stellmacki</i> (Holsinger, 1967)	FW
S.	<i>subtilis</i> (Hubricht, 1943)	FW
S.	<i>tahoensis</i> Holsinger, 1974	FW
S.	<i>tenuis tenuis</i> (S. I. Smith, 1874)	FW
S.	<i>t. potomacus</i> (Holsinger, 1967)	FW
S.	<i>tritatus</i> Holsinger, 1974	FW
S.	<i>vitreus</i> Cope, 1872	FW
S.	<i>wengerorum</i> Holsinger, 1974	FW
	<i>Synpleonia pizzini</i> Shoemaker, 1941	FW (At)
	<i>Synurella chamberlaini</i> Shoemaker, 1936?	FW (At - FL)
S.	<i>bifurca</i> (Hay, 1882)	FW
S.	<i>chamberlaini</i> (Ellis, 1941)	FW
S.	<i>dentata</i> Hubricht, 1943	FW
S.	<i>johanseni</i> Shoemaker, 1920	FW (P)

Superfamily Talitroidea Bulycheva, 1957**Family Hyalidae Bulycheva, 1957**

<i>Apohyale pugettensis</i> (Dana, 1853)	P (SE AL-CAL)
<i>A. anceps</i> (Barnard, 1969)	P (CAL-BC)
<i>A. californica</i> (Barnard, 1969)	P (BC-CAL)
<i>Hyale media</i> (Dana, 1853)	G (FL)
<i>H. nilssoni</i> Rathke 1843	At (AC)
<i>H. oculata</i> Bousfield, 1981	P (BC)
<i>H. perieri</i> (Lucas, 1846)	G (FL)
<i>Leptohyale longipalpa</i> Bousfield 1981	P (BC)
<i>Parallorchestes ochotensis</i> (Brandt, 1851)	P (AL-BC)
<i>P. brevicornis</i> Bousfield, 1981	P (AL-BC)
<i>P. minor</i> Bousfield, 1981	P (BC)
<i>P. spinosa</i> Bousfield, 1981	P (BC)?
<i>P. subcarinata</i> Bousfield, 1981	P (SE AL-WA)
<i>P. supracarinata</i> Bousfield, 1981	P (BER)
<i>P. trispinosa</i> Bousfield, 1981	P (BC)
<i>P. nuda</i> Bousfield, 1981	P (BC)
<i>P. americana</i> Bousfield, 1981	P (AL)
<i>P. minima</i> Bousfield, 1981	P (BC)
<i>P. occidentalis</i> Bousfield, 1981	P (BC)
<i>P. subcarinata</i> Bousfield, 1981	P (SE AL-WA)C
<i>Parhyale hawaiiensis</i> (Dana, 1853)	G (FL)
<i>P. fascigera</i> Stebbing, 1897	G (FL)
<i>Plumulohyale plumulosa</i> (Stimpson, 1857)	P (BC-CAL), At (V), G (FL?)
<i>Protohyale frequens</i> (Stout, 1913)	P (BC-CAL)
<i>P. canalina</i> Barnard, 1979	P (S CAL?)
<i>P. nigra</i> (Haswell, 1879)	P (CAL)
<i>P. lagunae</i> (Stout, 1913)	P (S CAL)
<i>P. intermedia</i> (Bousfield, 1981)	P (SE AL-ORE)
<i>P. seticornis</i> (Bousfield, 1981)	P (SE AL-CAL)
<i>P. oclairi</i> (Bousfield, 1981)	P (SE AL-WA)
<i>P. spinosa</i> (Bousfield, 1981)	P (SE AL-BC)

Family Hyalellidae Bulycheva, 1957**Subfamily Hyalellinae Bousfield, 1996**

<i>Allorchestes angusta</i> Dana, 1853	P (AL-CAL)
<i>A. bella bella</i> Barnard, 1974	P (BER-CAL)
<i>A. pacifica</i> Bousfield, 1981	P (BC)
<i>A. parva</i> Bousfield, 1981	P (BC)
<i>A. subcarinata</i> Bousfield, 1981	P (AL)
<i>A. urocarinata</i> Bousfield, 1981	P (SE AL-BC)
<i>A. carinata</i> Iwasa, 1939 (Bousfield, 1981)	P (BER)
<i>Hyalella (Hyalella) azteca</i> (Saussure, 1858)	FW
<i>H. (H.) inermis</i> S. I. Smith, 1974	FW
<i>H. (H.) longicornis</i> Bousfield, 1996	FW
<i>H. (H.) muerta</i> Baldinger, Shepard, & Threlhoff 2000	FW

<i>Hyaella</i>	(<i>H.</i>) <i>montezuma</i> Cole & Watkins, 1977	FW
<i>H.</i>	(<i>H.</i>) <i>sandra</i> Baldinger, Shepard, & Threlloff 2000	FW
<i>H.</i>	(<i>H.</i>) <i>texana</i> Stevenson & Peden, 1973	FW
<i>Parhyaella</i>	<i>whelpleyi</i> (Shoemaker, 1933)	G (FL)

Family Dogielinotidae Gurjanova, 1953

<i>Probosciniotus</i>	<i>loquax</i> (Barnard, 1968)	P (ORE-WA)
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Family Najnidae J. L. Barnard, 1972

<i>Najna</i>	<i>consiliorum</i> Derzhavin, 1937	P (BER)
<i>N.</i>	<i>kitimati</i> Barnard, 1979	P (CAL)
<i>N.</i>	<i>lessoniophilum</i> Bousfield, 1981	P (CAL)
<i>N.</i>	<i>rugosum</i> Bousfield, 1981	P (AL-BC)
<i>N.</i>	<i>setosum</i> Bousfield, 1981	P (BC-ORE?)
<i>N.</i>	<i>plumulosum</i> Bousfield, 1981	P (BC-ORE?)

Family Eophliantidae Sheard, 1936

<i>Lignophliantis</i>	<i>pyrifer</i> Barnard, 1969	P (S CAL)
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Family Phliantidae Stebbing, 1899

<i>Pariphinotus</i> (<i>Heterophlias</i>)	<i>escabrosus</i> (Barnard, 1969)	P (BC-CAL)
<i>P.</i>	(<i>H.</i>) <i>seclusus</i> (Shoemaker, 1933)	At (C), G (FL)

Family Talitridae Rafinesque, 1815

(a) Palustral subgroup (pragmatic subfamily group, Bousfield, 1984)

<i>Uhlorchestia</i>	<i>uhleri</i> (Shoemaker, 1930)	At (C-FL), G (FL-TEX)
<i>U.</i>	<i>spartinophila</i> Bousfield & Heard, 1986	At (V-C), G (FL)

(b) Beachflea subgroup (Bousfield, 1984)

<i>Orchestia</i>	<i>gammarella</i> (Pallas, 1766)	At (AC)
<i>Orcheslia</i>	<i>grillus</i> Bosc, 1802	At (AC-V); G (FL-TEX)
<i>Paciforchestia</i>	<i>klawei</i> (Bousfield, 1959)	P (S CAL- B.C)
<i>Platorchestia</i>	<i>chathamensis</i> Bousfield, 1982	P (BC)
<i>P.</i>	<i>platensis</i> (Kroyer, 1845)	At (AC-V), G (FL-TEX)
<i>Tethorchestia</i>	sp 1 (= <i>tropica</i> Shoemaker MS)	G (FL)
<i>Tethorchestia</i>	<i>brevipleopoda</i> (Bousfield MS)	G (FL)
<i>Traskorchestia</i>	<i>traskiana</i> (Stimpson, 1856)	P (AI -CAL)
<i>T.</i>	<i>georgiana</i> (Bousfield, 1958)	P (CAL -BC)
<i>T.</i>	<i>ochotensis</i> (Brandt, 1851)	P (ALEUT)
<i>Transorchestia</i>	<i>enigmatica</i> (Bousfield & Carlton, 1968)	P (CAL, intr.)

(c) Sandhopper subgroup (Bousfield, 1984)

<i>Americorchestia</i>	<i>longicornis</i> (Say, 1818)	At (AC-V), G
<i>A.</i>	<i>barbarae</i> Bousfield, 1992	G (TEX)

<i>Americorchestia heardi</i> Bousfield, 1992	G (FL-LA)
A. <i>megalophthalma</i> (Bate, 1862)	At (AC-C)
A. <i>salomani</i> Bousfield, 1992	G (FL-LA)
<i>Megalorchestia californiana</i> (Brandt, 1851)	P
M. <i>columbiana</i> (Bousfield, 1958)	P
M. <i>minor</i> (Bousfield, 1957)	P (S CAL)
M. <i>dexteræ</i> Bousfield, 1982	P (S-B CAL)
M. <i>pugettensis</i> (Stimpson, 1856)	P
M. <i>corniculata</i> (Stout, 1912)	P (CAL)
M. <i>benedicti</i> (Shoemaker, 1936)	P (CAL)

(d) Landhopper subgroup (Bousfield, 1984)

<i>Arcitalitrus sylvaticus</i> (Haswell, 1879)	P (CAL, intr.)
<i>Talitroides topitotum</i> (Burt, 1934?)	P (CAL, intr.), G (FL-MI, intr.)
T. <i>alluaudi</i> (Chevreux, 1896)	P (BC - CAL), At (intr.), G (FL)

Superfamily Pontoporeioidea Bousfield, 1979 [= Haustorioidea Barnard & Drummond, 1982 (part)]

Family Bathyporeiidae Bousfield, 1978

<i>Amphiporeia gigantea</i> Bousfield, 1973	At (AC)
A. <i>lawrenciana</i> Shoemaker, 1929	At (AC)
A. <i>virginiana</i> Shoemaker, 1933	At (AC), G (E FL?)
<i>Bathyporeia parkeri</i> Bousfield, 1973	At (V-C) G (E FL)
B. <i>quoddyensis</i> Shoemaker, 1949	At (AC-V)

Family Pontoporeiidae Dana, 1855

<i>Diporeia brevicornis</i> (Segerstrale, 1937)	FW
D. <i>erythrophthalma</i> (Waldron, 1953)	FW
D. <i>filicornis</i> (Smith, 1974)	FW
D. <i>hoyi</i> (Smith, 1874)	FW
D. <i>intermedia</i> (Segerstrale, 1977)	FW
D. <i>kendalli</i> (Norton, 1909)	FW
<i>Monoporeia affinis</i> (Lindstrom, 1885)	A-At (ST L), P (AL)
<i>Pontoporeia femorata</i> Kroyer, 1842	P (AL-BC)-A-At (ST L-AC)
<i>Priscillina armata</i> (Boeck, 1861)	A-At (ST L - AC)

Family Haustoriidae Stebbing, 1906

<i>Acanthohaustorius bousfieldi</i> Frame, 1982	At (V)
A. cf. <i>bousfieldi</i> Frame, 1980	G (E FL)
A. <i>intermedius</i> Bousfield, 1965	At (V-C)
A. nr. <i>intermedius</i> Bousfield, 1965	G (FL?)
A. <i>millsi</i> Bousfield, 1965	At (V-C) G (E. FL)
A. <i>uncinus</i> Foster, 1988	G (FL-MI)
A. <i>pansus</i> Thomas & Barnard, 1984	G (FL)
A. <i>shoemakeri</i> Bousfield, 1965	At (V-C)
A. cf. <i>shoemakeri</i> Bousfield 1965	G (NW FL)
A. <i>similis</i> Frame, 1980	At (V-C)

A. <i>spinosus</i> (Bousfield, 1962)	At (AC-Del)
A. <i>uncinus</i> Foster, 1989	G (FL-MI)
<i>Eohaustorius brevicuspis</i> Bosworth, 1973	P (BC-ORE)
E. <i>eous</i> (Gurjanova, 1951)	P (BER)
E. <i>sencillus</i> Barnard, 1962	P (CAL)
E. <i>washingtonianus</i> (Thorsteinsen, 1941)	P (AL-CAL?)
E. <i>estuarius</i> Bosworth, 1973	P (BC-ORE)
E. <i>sawyeri</i> Bosworth, 1973	P (BFC-ORE)
<i>Haustorius canadensis</i> Bousfield, 1962	At (SW G-V) (G (FL?))
H. <i>jayneae</i> Foster & LeCroy, 1991	G (NE)
<i>Lepidactylus dytiscus</i> Say, 1818	G (E FL)
L. <i>triarticulatus</i> Robertson & Shelton, 1980	G (FL-TEX)
<i>Neohaustorius biarticulatus</i> Bousfield, 1965	At (V-C), G (E FL?)
N. <i>schmitzi</i> Bousfield, 1965	At (V-C), G (E FL)
<i>Parahaustorius attenuatus</i> Bousfield, 1965	At (V)
P. <i>holmesi</i> Bousfield, 1965	At (AC) G (FL?)
P. <i>longimerus</i> Bousfield, 1965	At (V-C) G (FL?)
P. cf. <i>longimerus</i> Bousfield, 1965	G (W. FL)
P. <i>obliquus</i> Robertson & Shelton, 1978	G (FL-TEX)
<i>Protohaustorius bousfieldi</i> Robertson & Shelton, 1978	G (FL-TEX)
P. <i>deichmannae</i> Bousfield, 1965	At (V) G (FL?)
P. <i>wigleyi</i> Bousfield, 1965	At (V) G (FL?)
<i>Pseudohaustorius americanus</i> (Pearse, 1908)	G (FL-MI)
P. <i>borealis</i> Bousfield, 1965	At (V)
P. <i>caroliniensis</i> Bousfield, 1965	At V-CAR-E FL?)

Superfamily Gammaroidea Bousfield, 1977 [= gammaroid group Barnard & Barnard, 1983 (part)]

Family Gammaridae Leach, 1813

<i>Chaetogammarus stoerensis</i> (Reid, 1938)	At (AC)
C. <i>ischnus</i> (Sars, 1896)	FW (intr.)(Witt, et al, 1998))
<i>Eulimnogammarus obtusatus</i> (Dahl, 1938)	At (AC-ST L)
<i>Gammarus acherondytes</i> Hubricht & Mackin, 1940	FW
G. <i>annulatus</i> S. I. Smith, 1874	At (ST L - AC)
G. <i>bousfieldi</i> Cole & Minckley 1961	FW
G. <i>daiberi</i> Bousfield, 1969	P (CAL, intr.)-At (V-C)-G?
G. <i>desperatus</i> Cole, 1981	FW
G. <i>duebeni</i> Liljeborg, 1851	At (AC)
G. <i>fasciatus</i> Say, 1818	FW
G. <i>hyalelloides</i> Cole, 1976	FW
G. <i>jenneri</i> Bynum & Fox, 1977	At (V-C)
G. <i>lacustris lacustris</i> Sars, 1864	FW
G. <i>lawrencianus</i> Bousfield, 1956	A-At
G. <i>limnaeus</i> S. I. Smith, 1874	FW
G. <i>minus minus</i> Say, 1818	FW
G. <i>minus pinicollis</i> Cole, 1976	FW
G. <i>paynei</i> Delong, 1992	FW
G. <i>pecos</i> Cole & Bousfield, 1970	FW
G. <i>pseudolimnaeus</i> Bousfield, 1958	FW
G. <i>tigrinus</i> Sexton, 1939	At (AC-C)G (FL-LA)

<i>G. troglophilus</i> Hubricht & Mackin, 1940	FW
<i>G. (Lagunogammarus) oceanicus</i> (Segerstrale, 1947)	At (A-AC)
<i>G. (L.) setosus</i> Dementieva, 1931	P (AL-BC)-A-At
<i>G. (L.) wilkitzkii</i> (Birula, 1897)	A
<i>G. (Mucrogammarus) mucronatus</i> (Say, 1818)	At (AC-V-C), G(FL), P (Salton Sea)
<i>G. (M.) palustris</i> Bousfield, 1969	G (FL?)
<i>Marinogammarus finmarchicus</i> Dahl, 1938	At (AC-V-C)

Family Anisogammaridae Bousfield, 1977

<i>Anisogammarus pugettensis pugettensis</i> (Dana, 1853)	P (AL-CAL)
<i>A. amchitkana</i> Bousfield, 2001	P (AL-)
<i>A. epistomus</i> Bousfield, 2001	P (BC)
<i>A. slatteryi</i> Bousfield, 2001	P (BER-WA)
<i>Barrowgammarus mcginitiei</i> (Shoemaker, 1955)	P-A (BAR)
<i>Carineogammarus makarovi</i> (Bulycheva, 1952)	P (SE AL)
<i>Eogammarus oclairi</i> Bousfield, 1979	P (BC-ORE)
<i>E. confervicolus</i> (Stimpson, 1856)	P (SE AL- CAL)
<i>E. psammophilus</i> Bousfield, 1979	P (ALEUT)
<i>Locustogammarus levingsi</i> Bousfield, 1979	P (SE AL-BC)
<i>L. locustoides</i> (Brandt, 1851)	P (AL-BC)
<i>Ramellogammarus campestris</i> Bousfield & Morino, 1992	FW P (ORE)
<i>R. californicus</i> Bousfield & Morino, 1992	FW P (CAL)
<i>R. columbianus</i> Bousfield & Morino, 1992	FW P (BC-ORE)
<i>R. oregonensis</i> (Shoemaker, 1944)	FW P (ORE)
<i>R. ramellus</i> (Weckel, 1907)	FW P (CAL)
<i>R. similimanus</i> (Bousfield, 1961)	FW P (ORE)
<i>R. setosus</i> Bousfield & Morino, 1992	FW P (ORE)
<i>R. littoralis</i> Bousfield & Morino, 1992	FW P (ORE)
<i>R. vancouverensis</i> Bousfield, 1979	FW P (BC)
<i>Spinulogammarus subcarinatus</i> (Bate, 1862)	P (AL-BC)
<i>Spasskogammarus tzvetkovae</i> Bousfield, 1979	P (BER)

Family Gammaroporeiidae Bousfield, 1977

<i>Gammaroporeia alaskensis</i> (Bousfield & Hubbard, 1968)	P (SE AL)
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Family Mesogammaridae Bousfield, 1977

<i>Paramesogammarus americanus</i> Bousfield, 1979	P (SE AL)
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Superfamily Hadzioidea Bousfield, 1977 [= hadzioids Barnard & Barnard, 1983]

Family Allocrangoncytidae Holsinger, 1989

<i>Allocrangonyx hubrichti</i> Holsinger, 1971	FW
<i>A. pellucidus</i> (Mackin, 1935)	FW

Family Hadziidae S. Karaman, 1933

<u>Weckeliid subgroup (Holsinger, 1992) (= weckeliids of Barnard & Barnard, 1983)</u>	
<i>Allotxiweckelia hirsuta</i> Holsinger, 1980	FW (TX)

<i>Holsingerius samacos</i> (Holsinger, 1980)	FW
<i>H. smaragdinus</i> Holsinger, 1992b	FW
<i>Mexiweckelia hardeni</i> Holsinger, 1992b	FW
<i>Paramexiweckelia ruffoi</i> Holsinger, 1993	FW
<i>Texiweckelia texensis</i> (Holsinger, 1973)	FW (TEX)
<i>Texiweckeliopsis insolita</i> (Holsinger, 1980)	FW (TEX)

Hadziid subgroup (= hadziids of Barnard & Barnard, 1983)

<i>Dulzura sal</i> J. L. Barnard, 1969	P (CAL)
<i>Protohadzia</i> sp. Zimmerman & Barnard, 1977	G (FL?)
<i>P. schoenerae</i> (Fox, 1973)	At (C); G (FL)
<i>Metaniphargus beattyi</i> Shoemaker, 1942	G (FL?)
<i>Netamelita barnardi</i> McKinney et al, 1978	G (TEX)
<i>N. brocha</i> Thomas & Barnard, 1991c	G (FL)
<i>N. cortada</i> Barnard, 1962	P (S CAL)
<i>Spathiopsis loensis</i> Thomas & Barnard, 1985	G (FL)

Gammarellas (=nuuanids Barnard & Barnard, 1983)

<i>Tabatzius muelleri</i> (Ortiz, 1976)	G (FL-YUC)
<i>T. copillius</i> (McKinney & Barnard, 1977)	G (FL?-YUC)

Family Melitidae Bousfield, 1973 [= melitids + ceradocids sensu Barnard & Barnard, 1983 (part)]

<i>Abludomelita obtusa</i> (Monatagu, 1813)	P? (WA?), At (ST L)
<i>Anamaera hixon</i> Thomas & Barnard, 1985	G (FL)
<i>Bathyceradocus torelli</i> (Goes, 1966)	P (bathyal), A-At (ST L, deep)
<i>Ceradocus colei</i> (Kunkel, 1910)	At (V)
<i>C. paucidentatus</i> Barnard, 1952	P (CAL)
<i>C. rubromaculatus</i> (Stimpson, 1856)	P
<i>C. sheardi</i> Shoemaker, 1948	G (W FL)
<i>C. shoemakeri</i> Fox, 1973	At (C); G (FL)
<i>C. spinicauda</i> (Holmes, 1908)	P (BC-CAL)
<i>Denticeradocus</i> sp. (see Barnard, 1952)	P (CAL)
<i>Desdimelita barnardi</i> Jarrett & Bousfield, 1996	P (BC)
<i>D. desdichada</i> (J. L. Barnard, 1962)	P (SE AL-CAL)
<i>D. californica</i> (Alderman, 1936)	P (AL-CAL)
<i>D. microdentata</i> Jarrett & Bousfield, 1996	P (SE AL-ORE)
<i>D. microphthalma</i> Jarrett & Bousfield, 1996	P (SE AL)
<i>D. transmelita</i> Jarrett & Bousfield, 1996	P (BC)
<i>Dulichella appendiculata</i> (Say, 1818)	P (SCAL); At (C); G (FL-LA)
<i>Elasmopus antennatus</i> (Stout, 1913)	P (SE AL-CAL)
<i>E. balcomanus</i> Thomas & Barnard, 1988	G (FL)
<i>E. bampo</i> Barnard, 1979	P (CAL)
<i>E. holgurus</i> Barnard, 1962	P (CAL)
<i>E. lemaitrei</i> Ortiz, 1994	G (FL? CUBA)
<i>E. levis</i> (S. I. Smith, 1873)	At (V-C), G (FL)
<i>E. mutatus</i> Barnard, 1962	P (WA -CAL)
<i>E. pecteniscrus</i> (Bate, 1862)	G (FL)
<i>E. pocillimanus</i> (Bate, 1862)	G (FL)
<i>E. serricatus</i> Barnard, 1969	P (S CAL)
<i>E. thomasi</i> Ortiz, 1994	G (FL - CUBAt)
<i>Eriopisa elongata</i> Bruzelius, 1859	P (CAL) -At (V-C, shelf), G (FL?)

<i>E. incisa</i> McKinney, Kalke & Holland, 1978	G (TEX)
<i>E. schoenerae</i> Fox, 1973	G (FL?)
<i>Eriopisa</i> sp. (Barnard, 1952)	P (S CAL)
<i>Jerbarnia americana</i> Watling 1981	At (C-E FL)-, G (FL)
<i>Lupimaera lupana</i> (Barnard, 1969)	P (CAL)
<i>Maera danae</i> (Stimpson, 1853)	P-At (AC)
<i>M. cf. danae</i> Krapp-Schickel & Jarrett, 2000	P (AL-SE AL)
<i>M. loveni</i> (Bruzellius, 1859)	P (Al-WA)-A-At (N)
<i>M. fusca</i> (Bate, 1864)	P (AL-WA)
<i>M. nelsonae</i> Krapp-Schickel & Jarrett, 2000	P (BER-CAL)
<i>M. bousfieldi</i> Krapp-Schickel & Jarrett, 2000	P (BC-CAL)
<i>M. jerrica</i> Krapp-Schickel & Jarrett, 2000	P (SE AL- ORE)
<i>M. similis</i> Stout, 1913	P (BC-MEX)
<i>Maera diffidentia</i> J. L. Barnard, 1969	At (NC-G (FL)
<i>M. rathbunae</i> Pearse, 1908	G (FL-MI)
<i>Maera</i> sp. (nr. <i>rathbunae</i>) Krapp-Schickel & Jarrett, 2000	P (BC - At (NC)
<i>M. grossimana</i> (Montagu, 1808)?	P (BC-ORE)
<i>M. prionochira</i> Bruggen, 1907	P (AL)
<i>M. quadrimana</i> (Dana, 1853)	G (CUBA-FL)
<i>M. reishi</i> Barnard, 1979	P (CAL?)
<i>M. serrata</i> Schellenberg, 1938	G (CUBA-FL?)
<i>M. sulca</i> (Stout, 1913)	P (S CAL)
<i>M. williamsi</i> Bynum & Fox, 1977	At (C); G (FL)
<i>Megamoera amoena</i> (Hansen, 1887)	A
<i>M. bowmani</i> Jarrett & Bousfield, 1996	P (SE AL)
<i>M. borealis</i> Jarrett & Bousfield, 1996	P (SE AL)
<i>M. dentata</i> (Kroyer, 1842)	P-A-At
<i>M. glacialis</i> Jarrett & Bousfield, 1996	P (SE AL)
<i>M. kodiakensis</i> (Barnard, 1964)	P (SE AL)
<i>M. mikulitschae</i> (Gurjanova, 1953)	P (BER)
<i>M. rafiae</i> Jarrett & Bousfield, 1996	P (SE AL)
<i>M. subtener</i> (Stimpson, 1856)	P (BC-CAL)
<i>M. unimaki</i> Jarrett & Bousfield, 1996	P (ALEUT)
<i>Melita alaskensis</i> Jarrett & Bousfield, 1996	P (AL)
<i>M. intermedia</i> Sheridan, 1980	G (W FL)
<i>M. elongata</i> Sheridan, 1979	G (W FL)
<i>M. longisetosa</i> Sheridan, 1979	At (V-C). G (W FL)
<i>M. nitida</i> (S. I. Smith, 1874)	P (intr.)-At, G (E FL)
<i>M. oregonensis</i> Barnard, 1954	P (BC-CAL)
<i>M. shoemakeri</i> (= <i>M. nitida</i> Shoemaker, 1936)	G (YUC)
<i>M. sulca</i> (Stout, 1913)	P (S CAL)
<i>Melitoides makarovi</i> Gurjanova, 1934	P (BER)
<i>M. valida</i> (Shoemaker, 1964)	P (BER)
<i>Quadrimaera carla</i> Krapp-Schickel & Jarrett, 2000	P (BC - CAL)
? <i>Q. vigota</i> Barnard, 1969	P (CAL)
<i>Quasimelita quadrispinosa</i> (Vosseler, 1889)	PA (SE AL)-A-At (ST L)
<i>Q. formosa</i> (Murdoch, 1885)	A (AL)-At (ST L)
<i>Spathiopus looensis</i> Thomas & J. L. Barnard, 1985	G (FL)

Superfamily Bogidielloidea Bousfield, 1977 [= bogidiellids Barnard & Barnard., 1983 (part)]**Family Atesiidae Holsinger & Longley, 1980**

<i>Artesia welbourni</i> Holsinger, 1992b	FW TEX
<i>A. subterranea</i> Holsinger, 1980	FW TEX

Family Bogidiellidae Hertzog 1936

<i>Parabogidiella americana</i> Holsinger, 1980	FW TEX
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Superfamily Corophioidea Barnard & Barnard, 1983 (revised)**Family Ampithoidae Stebbing, 1899**

<i>Ampithoe dalli</i> Shoemaker, 1938	P (AL-ORE)
<i>A. divisura</i> Shoemaker, 1933	G (FL Keys)
<i>A. kussakini</i> Gurjanova, 1955	P (AL-BC))
<i>A. longimana</i> (S. I. Smith, 1873)	P?-At (V), G (W FL)
<i>A. lacertosa</i> Bate, 1858	P (AL-S CAL)
<i>A. plumulosa</i> Shoemaker, 1938	P (BC-S CAL)
<i>A. ramondi</i> Audoin, 1828 (= <i>A. divisura</i> ?)	P?, G (FL)
<i>A. rubricata</i> (Montague, 1808)	At (AC)
<i>A. rubricatoides</i> Shoemaker, 1938	P (BER)
<i>A. sectimanus</i> Conlan & Bousfield, 1982	P (SE AL-ORE)
<i>A. simulans</i> Alderman, 1936	P (AL-ORE)
<i>A. valida</i> S. I. Smith, 1873	P (BC-CAL), At (V)), G (FL)
<i>A. volki</i> Gurjanova, 1938	P (BER?)
<i>Cymadusa compta</i> (S. I. Smith, 1873)	AT (V), G (W FL)
<i>C. filosa</i> Savigny, 1816	G (FL)
<i>C. uncinata</i> (Stout, 1912)	P (BC-CAL)
<i>Peramphithoe eoa</i> (Barnard, 1954)	P (BER?)
<i>P. femorata</i> (Kroyer, 1845)	P-At?
<i>P. humeralis</i> (Stimpson, 1864)	P (SE AL-S CAL)
<i>P. mea</i> (Gurjanova, 1938)	P (ALEUT)
<i>P. lindbergi</i> (Gurjanova, 1938)	P (BER-CAL)
<i>P. stypotrumpetes</i> Conlan & Chess, 1992	P (SE AL-CAL)
<i>P. plea</i> (Barnard, 1965)	P (BC-CAL)
<i>P. tea</i> (Barnard, 1965)	P (SE AL-S CAL)
<i>Pleonexes aptos</i> Barnard, 1969	P (S CAL)
<i>Pseudamphithoides bacescui</i> Ortiz, 1976	G (FL?, CUBA)
<i>Sunamphitoe pelagica</i> (Milne-Edwards, 1830)	At (offshore), G

Family Biancolinidae J. L. Barnard, 1972

<i>Biancolina brassiacephala</i> Lowry, 1974	G
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Family Aoridae Stebbing, 1899

<i>Arctolembos arcticus</i> (Hansen, 1887)	A
<i>Acuminodeutopus heteruopus</i> Barnard, 1959	P (CAL)
<i>Aoroides columbiae</i> Walker, 1898	P (BER-CAL)

A. <i>exilis</i> Conlan & Bousfield, 1982	P (SE AL-CAL)
A. <i>inermis</i> Conlan & Bousfield, 1982	P (BC-CAL)
A. <i>intermedius</i> Conlan & Bousfield, 1982	P (BC)
A. <i>spinosus</i> Conlan & Bousfield, 1982	P (SE AL-ORE)
<i>Bemlos audbetti</i> Barnard, 1962	P (CAL)
B. <i>concavus</i> (Stout, 1913)	P (CAL-BC?)
B. <i>mackinneyi</i> Myers, 1978	G (FL)
B. <i>macromanus</i> Shoemaker, 1925	P (S CAL)
B. <i>sanmartini</i> Ortiz, Lalana & Lopez, 1992?	G (FL - CUBA)
<i>Columbaora cyclocoxa</i> Conlan & Bousfield, 1982	P (SE AL-S CAL)
<i>Grandidierella bonnieroides</i> Stephensen, 1948	G (W FI-TEX)
G. <i>notoni</i> Shoemaker, 1935	G? (YUC?)
G. <i>japonica</i> Stephensen, 1938	P (CAL-BC, intr.)
<i>Lembos (Arctolembos) arctica</i> Hansen, 1887	A-P (BER)
L. (<i>Globosolembos</i>) <i>francanni</i> Reid, 1951	G (FL)
L. (<i>Globosolembos</i>) <i>smithi</i> (Holmes, 1905)	G (FL-YUC)
L. <i>borealis</i> Myers, 1976	At (G-S)
L. <i>bruneomaculatus bruneomaculatus</i> Myers, 1977	G (FL)
L. <i>brunneomaculatus mackinneyi</i> Myers, 1978	G (FL-TEX)
L. <i>dentischium</i> Myers, 1977	G (FL)
L. <i>hypacanthus</i> (K. H. Barnard, 1916)	G (E FL)
L. <i>kunkelae</i> Myers, 1977	G (FL)
L. <i>minimus</i> Myers, 1977	G (FL)
L. <i>ovalipes</i> Myers, 1979	G (W FL)
L. <i>rectangulatus</i> Myers, 1977	G (FL)
L. <i>setosus</i> Myers, 1978	G (W FL)
L. <i>smithi</i> (Holmes 1905)	At (V-C)
L. <i>spinicarpus spinicarpus</i> (Pearse, 1912)	G (FL)
L. <i>spinicarpus inermis</i> Myers, 1979	G (W FL)
L. <i>tigris</i> Myers, 1981	G (W FL)
L. <i>tigrinus</i> Myers, 1979	G (W FL)
L. <i>tempus</i> Myers, 1981	G (W FL)
L. <i>unicornis</i> Bynum & Fox, 1977	At (C), G (FL)
L. <i>unifasciatus unifasciatus</i> Myers, 1977	G (FL)
L. <i>unifasciatus reductus</i> Myers, 1979	G (W FL)
L. <i>websteri</i> Bate, 1856	At (ST L; V), G (E FL?)
<i>Leptocheirus pinguis</i> (Stimpson, 1853)	A-At (AC)
L. <i>plumulosus</i> Shoemaker, 1932	At (V), G (E FI)
L. <i>rhizophorae</i> Ortiz, 1981	G (FL - CUBA)
<i>Liocuna caeca</i> Myers, 1981	G (W FL)
<i>Microdeutopus anomalus</i> (Rathke, 1843)	At (V)
M. <i>gryllotalpa</i> Costa, 1853	At (V)
M. <i>myersi</i> Bynum & Fox, 1977	At (C-FL), G (FL)
<i>Neohela monstrosa</i> Boeck, 1861	A-At (ST L)
N. <i>intermedia</i> Coyle & Mueller, 1981	P (W AL)
N. <i>pacifica</i> Gurjanova, 1953	P (CAL?)
<i>Paramicrodeutopus schmitti</i> (Shoemaker, 1942)	P (S CAL)
<i>Pseudunciola obliquua</i> (Shoemaker, 1949)	At (AC-V, shelf)
<i>Pterunciola spinipes</i> Just, 1977	At (off NC, deep)
<i>Rildardanus laminosa</i> (Pearse, 1912)	At (HAT)-G (W FL-AL)
<i>Rudilemboides naglei</i> Bousfield, 1973	At (V-C), G (FL)

<i>Unicola crassipes</i> Hansen 1887	A-At (N, slope)
<i>U. dissimilis</i> Shoemaker 1945	At (V-C), G (E FL?)
<i>U. inermis</i> Shoemaker 1945	A-At (AC-CHES)
<i>U. irrorata</i> Say, 1818	At (AC-V)
<i>U. laticornis</i> Hansen, 1887	A-At (AC-CV, deep)
<i>U. leucopis</i> (Kroyer, 1845)	A-At (AC)
<i>U. serrata</i> Shoemaker, 1945	G (FL-AL)
<i>U. spicata</i> Shoemaker, 1945	At, - G

Family Cheluridae Allman, 1847

<i>Chelura terebrans</i> Philippi, 1839	P (CAL, intr.), At (AC), G
<i>Tropichelura gomezi</i> Ortiz, 1976	G. (FL- CUBA)
<i>T. insulae</i> Barnard, 1959	G (FL)

Family Isaeidae Stebbing, 1906

<i>Ampelisciphotis podophthalma</i> (J L. Barnard, 1958)	P (CAL)
<i>Audulla chelifera</i> Chevreux, 1901	G (FL)
<i>Cheirimedia macrocarpa americana</i> Conlan, 1983	P (BC-ORE)
<i>C. macrodactyla</i> Conlan, 1983	P (BER)
<i>C. similicarpa</i> Conlan, 1983	P (AL-BC)
<i>C. zotea</i> (Barnard, 1962)	P (BC-CAL)
<i>Cheirophotis megacheles</i> (Giles, 1885)	P (CAL)
<i>Chevalia aviculae</i> Walker, 1904	P (BC); G (FL)
<i>C. carpenteri</i> Barnard & Thomas, 1987	G (FL)
<i>C. inaequalis</i> (Stout, 1913)	G (FL)
<i>C. mexicana</i> Pearse, 1913	G (FL-LA)
<i>Gammaropsis atlantica</i> Stebbing, 1888	G (FL)
<i>G. effrena</i> (Barnard, 1964)	P (CAL)
<i>G. ellisi</i> Conlan, 1983	P (C-CAL)
<i>G. inaequistylis</i> Shoemaker, 1930	A-At (ST L shelf)
<i>G. maculatus</i> (Johnston, 1827)	A-At (N)
<i>G. mamola</i> (Barnard, 1962)	P (CAL)
<i>G. marteisia</i> (Barnard, 1964)	P (CAL)?
<i>G. melanops</i> G. O. Sars, 1882	At (G)
<i>G. nitida</i> (Stimpson, 1853)	A-At (AC)
<i>G. ocellatus</i> Conlan, 1994	P (CAL, deep)
<i>G. ociosa</i> (J. L. Barnard, 1962)	P (CAL)
<i>G. shoemakeri</i> Conlan, 1983	P (BC- S. CAL)
<i>G. sophiae</i> (Boeck, 1861)	A-At (AC slope)
<i>G. spinosa</i> (Shoemaker, 1942)	P (BC-S.CAL)
<i>G. sutherlandi</i> Nelson, 1981	AT (N C), G (SE FL)
<i>G. thompsoni</i> (Walker, 1898)	P (SE AL-S CAL)
<i>Microtopotus raneyi</i> Wigley, 1966	At (C), G (W FL)
<i>M. shoemakeri</i> Lowry, 1972	At (V-C), G (E. FL- LA)
<i>Pareurystheus alaskensis</i> (Stebbing, 1910)	P (AL)
<i>P. dentatus</i> (Holmes, 1908)	P (BER-BC)
<i>P. tzvetkovae</i> (Conlan, 1983)	P (AL)
<i>Photis bifurcata</i> Barnard, 1962	P (WA-CAL)
<i>P. brevipes</i> Shoemaker, 1942	P (AL-CAL)

<i>P. californica</i> Stout, 1913	P (CAL)
<i>P. chiconola</i> Barnard, 1962	P (deep)
<i>P. conchicola</i> Alderman, 1936	P (WA-CAL)
<i>P. dentata</i> Shoemaker, 1945	At (V) G (FL)
<i>P. elephantis</i> Barnard, 1962	P (CAL)
<i>P. fischmanni</i> Gurjanova, 1938	P (BER)
<i>P. kurilica</i> Gurjanova, 1955	P (BER-ORE)
<i>P. lacia</i> J. L. Barnard, 1962	P (BC-CAL)
<i>P. linearmanus</i> Conlan, 1994	P (CAL)
<i>P. longicaudata</i> (Bate & Westwood, 1862)	G (FL)
<i>P. macromana</i> McKinney et al, 1978	G (FL-W TEX)
<i>P. macinerneyi</i> Conlan, 1983	P (BC-WA)
<i>P. macrocoxa</i> Shoemaker, 1945	At (AC-V)
<i>P. macrotica</i> Barnard, 1962	P (CAL)
<i>P. melanica</i> McKinney, 1980	G (FL-TEX)
<i>P. oligochaeta</i> Conlan, 1983	P (SE AL -BC)
<i>P. pachydactyla</i> Conlan, 1983	P (SE AL-BC)
<i>P. parvidons</i> Conlan, 1983	P (BC -WA)
<i>P. pugnator</i> Shoemaker, 1945	At (C-FL), G (FL)
<i>P. reinhardi</i> Kroyer, 1842	P?-A-At (AC-BF)
<i>P. spasskii</i> Gurjanova, 1951	P (AL-BC)
<i>P. spinicarpa</i> Shoemaker, 1942	P (CAL)?
<i>P. tenuicornis</i> G. O. Sars, 1882	A-At (G-I, C)
<i>P. trapherus</i> Thomas & Barnard, 1991b	G (FL)
<i>P. typhlops</i> Conlan, 1994	P (CAL, deep)
<i>P. viuda</i> J. L. Barnard, 1962	P (S CAL)
<i>Podoceropsis amchitkensis</i> Conlan, 1983	P (AL)
<i>P. angustimana</i> Conlan, 1983 (= <i>G. ociosa</i> ?)	P (BC)
<i>P. barnardi</i> (Kurjaschov & Tzvetkova, 1975)	P (BER -BC)
<i>P. chionoecetophila</i> Conlan, 1983	P (ALEUT-ORE)
<i>P. setosa</i> Conlan, 1983	P (AL)
<i>Protomedeia articulata</i> Barnard, 1962	P (ORE-S CAL)
<i>P. fasciata</i> Kroyer, 1842?	P? (WA), A-At
<i>P. grandimana</i> Bruggen, 1905	P (BER-BC)A-At
<i>P. penates</i> Barnard, 1966	P (BC CA)
<i>P. prudens</i> Barnard, 1966	P (BC-S CAL)
<i>P. stephensi</i> Shoemaker, 1955	A-At (ST L)

Family Neomegamphopidae Myers, 1981

<i>Neomegamphopus heardi</i> Barnard & Thomas, 1987	G (FL)?
<i>N. hiatus</i> Barnard & Thomas, 1987	G (FL)
<i>N. kalanii</i> Barnard & Thomas, 1987	G (E FL)
<i>N. pachiatatus</i> Barnard & Thomas, 1987	G (S FL)?
<i>N. roosevelti</i> Shoemaker, 1942	G (FL)

Family Ischyroceridae Stebbing, 1899

(contains subfamilies Cerapiinae Budnikova and Ischyrocerinae Stebbing)

<i>Bonnierella linearis californica</i> Barnard, 1966	P (OR-deep)
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<i>Cerapus tubularis</i> Say, 1818	At (V-C)
<i>C. benthophilus</i> Thomas & Heard, 1979	G (FL)
<i>C. cudjoe</i> Lowry & Thomas, 1991	G (FL)
<i>Erichthonius brasiliensis</i> (Dana, 1853)	P (intr.?), G (FL)
<i>E. difformis</i> Milne-Edwards, 1830	P (WA?), A-At
<i>E. fasciatus</i> (Stimpson, 1853)	AT (ST L-V)
<i>E. rubricornis</i> (Stimpson, 1853)	P (BER-CAL),- At
<i>E. tolli</i> Bruggen, 1909	A-At (ST L)
<i>Ischyrocerus anguipes</i> (Kroyer, 1838)	P-A-At (to DEL) (not FL!)
<i>I. claustris</i> (Barnard, 1969)	P (CAL)
<i>I. commensalis</i> Chevreux, 1900	A-At (ST L)
<i>I. gurjanovae</i> Kudrjaschov, 1975	P (BER)
<i>I. latipes</i> Kroyer, 1842	A-At (ST L, slope)
<i>I. malacus</i> Barnard, 1964	P (CAL, deep)
<i>I. megalops</i> G. O. Sars, 1894	At (G-EM)
<i>I. nanoides</i> (Hansen, 1887)	P (WA?), At (ST L)
<i>I. parvus</i> Stout, 1913	P (S CAL)
<i>I. pegalops</i> Barnard, 1962	P (CAL)
<i>I. serratus</i> Gurjanova, 1938	P (AL?)
<i>I. tuberculatus</i> (Hoek, 1882) Gurjanova	P (BER)
<i>I. tzvetkovae</i> Kudrjaschov, 1975	P (BER)
<i>Jassa borowskyae</i> Conlan, 1990	P (AL-CAL)
<i>J. carltoni</i> Conlan, 1990	P (CAL)
<i>J. marmorata</i> Holmes, 1903	P - At (ST L -V-C)- G (E FL),
<i>J. morinai</i> Conlan, 1990	P (BC-CAL)
<i>J. myersi</i> Conlan, 1990	P (CAL)
<i>J. oclairi</i> Conlan, 1990	P (AL-BC)
<i>J. shawi</i> Conlan, 1990	P (BC-CAL)
<i>J. slatteryi</i> Conlan, 1990	P (BC-CAL)
<i>J. staudei</i> Conlan, 1990	P (SE Al - BC, ORE)
<i>Microjassa bahamensis</i> Conlan, 1995	At (E FL?)
<i>M. boreopacifica</i> Conlan, 1995	P (SE AL-BC)
<i>M. barnardi</i> Conlan, 1995	P (ORE-CAL)
<i>M. bousfieldi</i> Conlan, 1995	P (CAL)
<i>M. floridensis</i> Conlan, 1995	G (FL)
<i>M. litotes</i> Barnard, 1954	P (BC-CAL)
<i>M. macrocoxa</i> Shoemaker (1942)	AT (AC-G?)
<i>M. micropalpa</i> Shoemaker (1942)	At (V-C?)
<i>M. tetradonta</i> Conlan, 1995	P (CAL?) G (FL)
<i>Parajassa angularis</i> Shoemaker, 1942	P (CAL?)
<i>Ventojassa ventosa</i> (Barnard, 1962)	P (CAL, deep)
<i>Neoischyrocerus claustris</i> (J. L. Barnard, 1969)	P (CAL)

Family Corophiidae Dana, 1849

Subfamily Corophiinae Bousfield & Hoover, 1997

<i>Americorophium spinicorne</i> (Stimpson, 1957)	P (AL-CAL)
<i>A. aquafuscum</i> (Heard & Sikora, 1972)	At (C), G (FL-MI)
<i>A. brevis</i> (Shoemaker, 1949)	P (SE AL-CAL)
<i>A. ellisi</i> Shoemaker, 1943	G (FL-LA)

A. <i>salmonis</i> (Stimpson, 1857)	P (SE AL-WA)
A. <i>stimpsoni</i> (Shoemaker, 1941)	P (CAL)
<i>Apocorophium acutum</i> (Chevreux, 1908)	P (CAL, intr), At (V-C). G (FL)
A. <i>lacustre</i> (Vanhoffen, 1911)	At (V). G (E FL)
<i>Apocorophium simile</i> (Shoemaker, 1934)	At (C-E FL)
A. <i>louisianum</i> (Shoemaker, 1934)	G (FL-LA)
<i>Corophium volutator</i> (Pallas, 1776)	At (AC)
<i>Crassikorophium crassicornis</i> (Bruzellius, 1859)	P-A-At (tAC-CHES)
C. <i>clarencense</i> (Shoemaker, 1949)	P-A (BER)
C. <i>bonelli</i> (Milne Edwards, 1830)	P-A-At (AC)(not FL!)
<i>Laticorophium baconi</i> (Shoemaker, 1934)]	P (AL-CAL) (not FL!)
<i>Monocorophium insidiosum</i> (Crawford, 1937)	P (BC-CAL, intr?), At (ST L; V) (FL?)
M. <i>acherusicum</i> (Costa, 1857)	P (AL-CAL) A-At (CHES), G (FL)
M. <i>californianum</i> (Shoemaker, 1934)	P (BC-CAL)
M. <i>carlottensis</i> Bousfield & Hoover, 1997	P (BC-SE AL)
M. <i>oaklandense</i> (Shoemaker, 1949)	P (CAL)
M. <i>steinegeri</i> (Gurjanova, 1951)	P (BER)
M. <i>uenoi</i> (Stephensen, 1932)	P (CAL, intr.)
M. <i>tuberculatum</i> (Shoemaker, 1934)	At (V-C), G (FL)
<i>Sinocorophium alienensis</i> (Chapman, 1988)	P (CAL, intr.)

Subfamily Siphonoecetinae Just, 1983

<i>Siphonoecetes smithianus</i> Rathbun, 1905	At (V, shelf)
<i>Caribboecetes crassicornis</i> Just, 1984	G (FL?)

Family Podoceridae Leach, 1814

<i>Dulichia rhabdoplastis</i> McLoskey, 1970	P (SE AL-CAL)
D. <i>tuberculata</i> Boeck, 1870	P (WA?)-A-At (ST L)
<i>Dulichiosis remis</i> (Barnard, 1964)	P (AL?)
<i>Dyopedos arcticus</i> (Murdoch, 1885)	P (WA, CAL)-A-At (ST L)
D. <i>bispinus</i> (Gurjanova, 1930)	P (AL-BC)-At
D. <i>falcata</i> (Bate, 1857)	A-At (ST L, slope)
D. <i>monacanthus</i> (Metzger, 1875)	A-At (ST L - CHES)
D. <i>porrectus</i> Bate, 1857	A-At (ST L)
D. <i>spinosissima</i> Kroyer, 1845	A-At (AC, slope)
D. <i>unispinus</i> (Gurjanova, 1951)	P (BER)
<i>Paradulichia typica</i> Boeck, 1870	PA (Barrow), At (ST L, slope)
<i>Podocerus brasiliensis</i> (Dana, 1853)	P (S CAL), G (FL)
P. <i>chelonophilus</i> Chevreux & DeGuene, 1888	G (FL)(see Thomas & Barnard, 1992a)
P. <i>cristatus</i> (Thomson, 1879)	P (CAL)
P. <i>fulanus</i> Barnard, 1962	P (S CAL)
P. <i>kleidus</i> Thomas & Barnard, 1992b	G (Fl)
P. <i>spongiculus</i> Alderman, 1936	P (BC?-CAL)

SUBORDER CAPRELLIDEA Leach, 1814

Superfamily Caprelloidea Laubitz, 1993

Family Caprogammaridae Kudrjaschov & Vassilenko, 1966, emend McCain, 1970

Subfamily Caprogammarinae K. & V., 1966

Caprogammarus gurjanovae Kudrjaschov & Vassilenko, 1966 WNP

Family Caprellidae White, 1847, emend McCain, 1970

Subfamily Caprellinae Leach, 1814

<i>Caprella angusta</i> Mayer, 1903	P (BC-ORE)
<i>C. alaskana</i> Mayer, 1903	P (BER-ALEUT-CAL))
<i>C. andreae</i> (Mayer, 1890)	At (AC)- G
<i>C. borealis</i> Mayer, 1903	P (AL-WA)
<i>C. brevirostris</i> Mayer, 1903	P (CAL)
<i>C. californica</i> Stimpson, 1857	P (BC-CAL)
<i>C. carina</i> Mayer, 1903	A
<i>C. ciliata</i> G.O. Sars, 1880?	P (AL)-N At
<i>C. constantina</i> Mayer, 1903?	P (BER)
<i>C. cristibrachium</i> Mayer, 1903?	P (BER-ALEUT)
<i>C. danielevskii</i> Czern. 1868	At (FL)- G
<i>C. drepanocheir</i> Mayer, 1890	P (AL-WA)
<i>C. dubia</i> Hansen, 1888	At -A
<i>C. equilibra</i> Say, 1818	At (V) - G - P (BC-WA intr?)
<i>C. gracilior</i> Mayer, 1903	P (AL-CAL)
<i>C. greenleyi</i> McCain, 1969	P (ORE-CAL)
<i>C. incisa</i> Mayer, 1903	P (SE AL-CAL)
<i>C. irregularis</i> Mayer, 1890	P (AL-WA)
<i>C. kincaidi</i> Holmes 1904?	P (BER)
<i>C. laeviuscula</i> Mayer, 1890?	P (AL-ORE)
<i>C. linearis</i> L. 1758	A-At-N P
<i>C. mendax</i> Mayer, 1903	P (BC)
<i>C. mutica</i> Schurin, 1935	P (CAL)
<i>C. natalensis</i> Mayer, 1903	P (BC-CAL)
<i>C. paulina</i> Mayer, 1903	P (BER-ALEUT)
<i>C. penantis</i> Leach, 1814	At-G; P (CAL intr?)
<i>C. pilidigita</i> Laubitz, 1970	P (BC-WA)
<i>C. pilipalma</i> Dougherty & Steinberg, 1953	P (CAL)
<i>C. pustulata</i> Laubitz, 1970	P (SE AL-ORE)
<i>C. radiuscula</i> Laubitz, 1970	P (SE AL-WA)
<i>C. rinki</i> Stephensen, 1933	At (deep)
<i>C. scabra</i> Holmes, 1904	P (SE AL)
<i>C. scaura</i> Templeton, 1836	P (CAL)-At
<i>C. septentrionalis</i> Kroyer, 1842?	P (BER?), A-At
<i>C. striata</i> Mayer, 1903	P (AL-WA?)-A
<i>C. trispinus</i> Honeyman, 1889	At (deep)
<i>C. unguina</i> Mayer, 1903	P (BC, deep)
<i>C. unica</i> Mayer, 1903	At

<i>C. uniforma</i> La Follette, 1915	P (CAL)
<i>C. verrucosa</i> Boeck, 1872	P (BC-CAL)
<i>Metacaprella anomala</i> (Mayer, 1903)	P (AL-CAL)
<i>M. ferresa</i> Mayer, 1903	P (A-CAL)
<i>M. horrida</i> G. O. Sars, 1880	At-A
<i>M. kennerlyi</i> (Stimpson, 1864)	P (AL-CAL)

Subfamily Aeginellinae Vassilenko, 1968

<i>Aeginella spinosa</i> Boeck, 1861	N At (deep)
<i>Aeginina longicornis</i> (Kroyer, 1842)	A-At

Family Pariambidae Laubitz, 1993

<i>Deutella californica</i> Mayer, 1890	P (SE AL-CAL)
<i>D. abracadabra</i> Steinberg & Dougherty, 1952	At-G
<i>D. incerta</i> Mayer, 1903	G
<i>Hemiaeginina minuta</i> Mayer, 1890	At, G
<i>Luconacea incerta</i> Mayer, 1903	At (V)
<i>Paracaprella tenuis</i> Mayer, 1903	At (V)
<i>P. pusilla</i> Mayer, 1890	At G
<i>P. cf. temir</i> (fide Nelson, 1995)	G

Family Protellidae McCain, 1970, emend Laubitz, 1993

<i>Mayerella limicola</i> Huntsman, 1915	At
<i>M. banksia</i> Laubitz, 1970	P (AL-CAL)
<i>M. acanthopoda</i> Benedict 1997	P (S CAL)
<i>Protellina ingolfi</i> Stephensen (1942?)	N At (deep)
<i>Proaeginina norvegica</i> (Stephensen, 1931)	N At
<i>Protoaeginella</i> sp. Laubitz & Mills, 1972	N At
<i>Tritella pilimana</i> Mayer 1903	P (AL-ORE)
<i>T. laevis</i> Mayer, 1903	P (BC-S CAL)
<i>T. tenuissima</i> Doughty & Steinberg 1953	P (CAL, deep)

Family Paracercopidae Vassilenko, 1968

<i>Cercops holbolli</i> Kroyer, 1842	A
<i>C. compactus</i> Laubitz, 1970	P
<i>Paracercops setifer</i> Vassilenko, 1972	P (BER?)

Family Caprellinoididae Laubitz, 1993

<i>Pseudaeginella biscaynensis</i> (McCain, 1968)	At (FL) G
<i>Pseudoliropus vanus</i> Laubitz, 1970	P (BC, deep)

Family Phtisicidae Vassilenko, 1968**Subfamily Phtisicinae Vassilenko, 1968**

<i>Phtisica marina</i> Slabber, 1769	At-G
<i>Perotripus brevis</i> (La Follette, 1915)	P (AL-S CAL)
<i>Hemiproto wigleyi</i> McCain, 1968	At (G -E FL)

Infraorder Cyamida Bousfield, 1979**Family Cyamidae Rafinesque, 1817 (revised Margolis, McDonald, & Bousfield 2000)**

<i>Cyamus</i> (<i>Cyamus</i>) <i>ceti</i> (L.) Lamarck, 1801	P (AL-CAL), At	on <i>Balaena mysticetus</i>
<i>C.</i> (<i>Cyamus</i>) <i>erraticus</i> R. de Vauzeme, 1834	P (BC)-At	on <i>Balaena glacialis</i>
<i>C.</i> (<i>Cyamus</i>) <i>ovalis</i> R. de Vauzeme, 1834	P (SE AL)	on <i>Balaena glacialis</i>
<i>C.</i> (<i>Cyamus</i>) <i>gracilis</i> R. de Vauzeme, 1834	P (SE AL)-At	on <i>B. gracilis</i>
<i>C.</i> (<i>Cyamus</i>) <i>monodontis</i> Lutken, 1873	P (BER)-A-At	on beluga, narwhal
<i>C.</i> (<i>Cyamus</i>) <i>nodosus</i> Lutken, 1860	A	on narwhal
<i>Cyamus</i> (<i>Paracyamus</i>) <i>balaenopterae</i> K. H. Barnard, 1931	P-At	on balaenopterae (blue, fin)
<i>C.</i> (<i>Paracyamus</i>) <i>boopis</i> Lutken, 1870	P (AL-CAL), Atl	on <i>Megaptera</i>
<i>Cyamus</i> (<i>Mesocyamus</i>) <i>catodontis</i> Margolis, 1954	P (BC)-At	on <i>Physeter</i>
<i>C.</i> (<i>Mesocyamus</i>) <i>orubraedon</i> Waller, 1989	P	on <i>Berardius bairdi</i>
<i>C.</i> (<i>Mesocyamus</i>) <i>mesorubraedon</i> Margolis et al., 2000	P	on <i>Physeter</i>
<i>Cyamus</i> (<i>Apocyamus</i>) <i>scammoni</i> Dall, 1872	P (AL-CAL)	on <i>Eschrichtius</i>
<i>C.</i> (<i>Apocyamus</i>) <i>eschrichtii</i> Margolis et al, 2000	P	on <i>Eschrichtius</i>
<i>C.</i> (<i>Apocyamus</i>) <i>kessleri</i> Brandt, 1872	P (AL-CAL)	on <i>Eschrichtius</i>
<i>Orcinocyamus orcinus</i> (Leung, 1870)	P (BC+)	on <i>Orcinus orca</i>
<i>Isocyamus delphini</i> (Guerin-Meneville, 1836)	P (AL-CAL)	on porpoises, dolphins
<i>I.</i> <i>globicipitis</i> Lutken, 1973	At	on <i>Globicephalus</i>
<i>I.</i> <i>kogia</i> Sedlak-Weinstein, 1992	P (CAL?)	on <i>Kogia</i> (pygmy sperm)
<i>Neocyamus physeteris</i> (Pouchet, 1888)	P (SE AL-BC)	on <i>Physeter</i> , <i>Globicephalus</i>
<i>Platycyamus flaviscutatus</i> Waller, 1989	P	on <i>Berardius bairdi</i>
<i>Platycyamus thompsoni</i> (Gosse, 1855)	At	on <i>Hyoperodon</i>
<i>ampullatus</i>		
<i>Syncyamus pseudorca</i> Bowman, 1955	At	on <i>Pseudorca</i>
<i>Scutocyamus parvus</i> Lincoln & Hurley, 1974	At	on white-beak dolphin (<i>Cephalorhynchus</i>)

NOTES